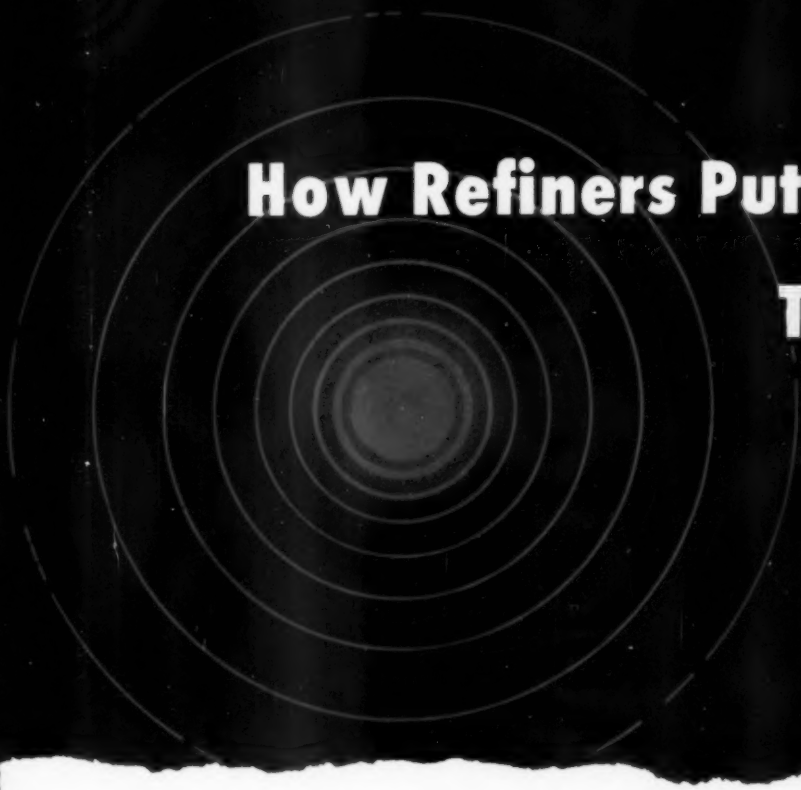
the OIL AND GAS JOURNAL

SEPTEMBER 23, 1957



How Refiners Put Isotopes To Work...

A comprehensive study by the Journal's refining editor

P. 91

New Mud Pump Is Light, Powerful p. 68

Home-Care Insurance Plan Popular p. 72

STATISTICAL SECTION P. 188

From Oasis to Igloo

. . . from the scorching deserts of Saudi Arabia to the frozen tundra of Northern Canada . . . wherever they're drilling for, or producing oil in the free world . . . the "Flying H" of Halliburton is a familiar and welcome sight to oilmen. It's a symbol that tells drilling and production men that they can get the same quality service, equipment and materials in Dharan and Tucipido that are available in Amarillo and Bradford.

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the OIL AND GAS JOURNAL Newsletter

Sept. 23, 1957
Tulsa, Okla.

Depressed oil market is creating financial crisis in Texas:

The Texas government's health is geared closely to the flow of oil. An overpowering percentage of its tax revenue comes from the industry.

Thus it's easy to realize what the string of 13-day producing months is doing to state income. Tax revenue has plunged far below expected levels, even considering the unusual but short-lived production early in the year during the Suez Canal crisis.

The Texas treasury, in fact, will run into a deficit within the next few months, according to word passed to the Texas Legislative Budget Board by its director, Vernon McGee. The director added another warning: Unless something happens to restore oil production, the 1959 legislature will face the greatest financial headache in state history.

There is a move afoot to put the state's tax eggs in more than one basket.

A new state tax study commission has just been named and is about ready to review Texas' entire tax structure and report to the legislature next year.

Oil leaders in the state have a 3-ply job cut out for themselves before the commission: Convince the politicos that oil's tax share already is far out of proportion, that oil and gas should not be taxed further, and that the tax load should be distributed more evenly both for the state's good and that of the oil industry.

Colorado oil men also have a tax job cut out for them.

An influential legislator, Sen. Herrick Roth of Denver, is demanding an investigation of the Colorado severance tax with an eye to increasing it. "We ought to take a look at oil and gas production as a possible source of revenue," says Roth.

The senator is talking about a straight 5 per cent tax. The present levy is a graduated tax on oil and gas income ranging up to a 5 per cent rate depending on volume of production.

Economics has pulled the rug out from under Amoco Chemicals' expensive gas-synthesis project at Brownsville, Tex.

The story of what happened is one of the strangest twists in processing news this year.

The plant was a technical success: By whipping many tough problems, technologists proved that gasoline can be made commercially from air and natural gas. But while this was happening, economics changed. When the product came to market, it cost too much for the money it would bring.

Amoco now is shutting down the whole venture. Immediate effect will be to cut 1957 earnings of parent company, Indiana Standard, by $5 million. But that is only a fraction of the loss sustained by Indiana Standard and several other oil companies involved in the project over the years.

Gulf's new hammer drill may be available to the industry soon. Continental-Emsco has been awarded rights to manufacture and distribute the new-type percussion tool.

Claims made for the tool by scientists who developed it: The drill makes hole straighter and faster than conventional tools and the bits last longer.

Drilling costs in California may not be so far out of line as they seem. Cost data indicate they're higher than those in every state except one.

But footage prices in California actually have dropped 16 per cent in the last 10 years. This was achieved through efficiency: By increasing rate of penetration 48 per cent at a time when daily operating costs of drilling contractors were rising 42 per cent.

Cost figures don't tell the whole story, though. California operators drill a larger proportion of deep wells, can't take advantage of special tools available in the Mid-Continent area, and complete a larger number of their wells, with resulting higher costs in completion fluids, casing, and rig time (p. 101).

Batting average of offshore operators has slumped badly. Completions off the coast of Louisiana are up some 45 per cent over the same period last year. But more important: Number of dry holes has been running about 80 per cent ahead of a year ago. Ironically, most of the activity increase has been in development drilling.

A drop in the offshore success ratio was expected eventually. Most companies obviously drilled their better prospects first. The trend now developing, however, again emphasizes the constant struggle offshore operators must wage with mounting costs.

In another offshore area: After 2 years of inactivity, California now is showing a burst of speed to put 54,000 acres of offshore leases on the auction block. The area is off Santa Barbara County between Point Conception and Elwood.

The big question there: What will the royalty rate be? It's a cinch to go up because under a new law the minimum royalty offshore now will be 16 2/3 per cent. It can be scaled up from there.

Michigan operators now have high hopes for heavy oil production in the deeper pay zones of the historic Trenton formation.

A development well in Scipio field in southern Michigan flowed wild for 25 hours. Production was estimated at 200 bbl. of oil per hour and 10,000 M.c.f. of gas. The strike by Aurora Gasoline Co. and McClure Oil Co. is sure to touch off new Michigan exploration activity.

That once-disappointing Sun Oil well in Lake Maracaibo now apparently will be completed as a producer. Latest reports from Venezuela on the well brighten a lot of long faces among the group of companies interested in the expensive block of acreage.

In a 2-hour test from 11,050 ft. the SVSX-1 on Block 1 reportedly flowed at rate of 480 bbl. daily through a 3/8-in. choke. Completion work is now underway. Atlantic Refining and Seaboard Oil also own interests in the acreage.

Adena field's new water flood has an unusual approach.

Water is being injected into the Colorado project updip from the oil and above the gas-oil contact. Injection wells are located so they will sweep all the oil downdip to oil-producing wells.

Reason for this type of water injection is the gas cap at Adena. If water were injected into the water zone downdip, some of the oil would be forced up into the gas cap and lost (p. 121).

Imports-control job faced by Capt. M. V. Carson, Jr., is getting tougher by the day. Two events of last week point up his ticklist situation:

...Other importers warn that substantial increases in allowable imports for those presently complaining might upset the entire government plan.

...First monthly reports from importers show that December imports will be 174,000 bbl. daily under August but still 52,600 bbl. above quotas. That means toughest part of the slimming-down job must come next year (p. 65).

Domestic refiners have launched an attack against plans by the military to buy 8 million barrels of jet fuel in the Caribbean within the next 6 months.

One independent refiner, R. B. Kahle of Eastern States Petroleum, Houston, claims contracts let to Caribbean refiners will crack the voluntary import-control program wide open. His claim: The purchase means domestic producers will lose a market at the refinery for 150,000 bbl. daily of their oil. That's about half the gain hoped to be realized through a reduction in imports.

Military supply officials deny the purchase conflicts with the imports-control plan. They point out products imports are not controlled.

Savings of $10 million were realized last year by the oil industry from use of radioactive isotopes.

A Journal survey of isotope technology in refining (p. 91) shows the oil industry is still by far the greatest user of these atomic-age products. Actually, the industry now is merely beginning to realize benefits from isotope usage.

The outlook: Within the next 10 years use of isotopes and other atomic energy sources will spread on the fantastic side. Savings to all industry will run at least to a billion dollars during the decade.

Refiners in smog-conscious Los Angeles are going to great pains to make their plants unseen, unheard, and unsmelled.

General Petroleum, for instance, has just spent $500,000 at its Torrance refinery to eliminate a steam cloud that's visible in the heavily populated area but wasn't a real contribution to air pollution.

Brown & Root is betting heavily that offshore pipelining will contines its upswing next year.

The company has ordered another king-size pipe-laying barge. The second piece of equipment is even larger than the first one which went to work earlier this year on the T.G.T. offshore pipeline. The 350-ft. craft is being built by Levingston at Orange and will be ready by February.

Brown & Root may have wind of a major project in the offing. There are reports on the coast that a major company is planning the biggest offshore gas line yet undertaken. Plans call for gathering and processing 500,000 M.c.f. daily off Cameron Parish. The gas would be sold to one or more transmission lines in the area.

Mexican gas could be moving north to California before long.

Edwin Pauley reportedly is behind the scheme. Although his plan to pipe Mexican gas to Cuba has grabbed more headlines, insiders say the Mexico-to-California idea is more likely to succeed.

Gas fields on the Isthmus of Tehuantepec are no farther away than those in Alberta which will supply the Pacific Gas & Electric line into California.

Offshore gas producers, meanwhile, are on notice that the C.A.T.C. Group's victory in putting over a price of more than 21 cents per M.c.f. doesn't mean that will be the going price.

FPC Commissioner Connole, who opposed the C.A.T.C. certificate, insists every producer will have to justify his price.

That Onassis-Nasser deal for a Suez pipeline has clabbered.

Egypt has broken off talks with the Greek ship magnate. Main trouble: Lack of interest by other investors.

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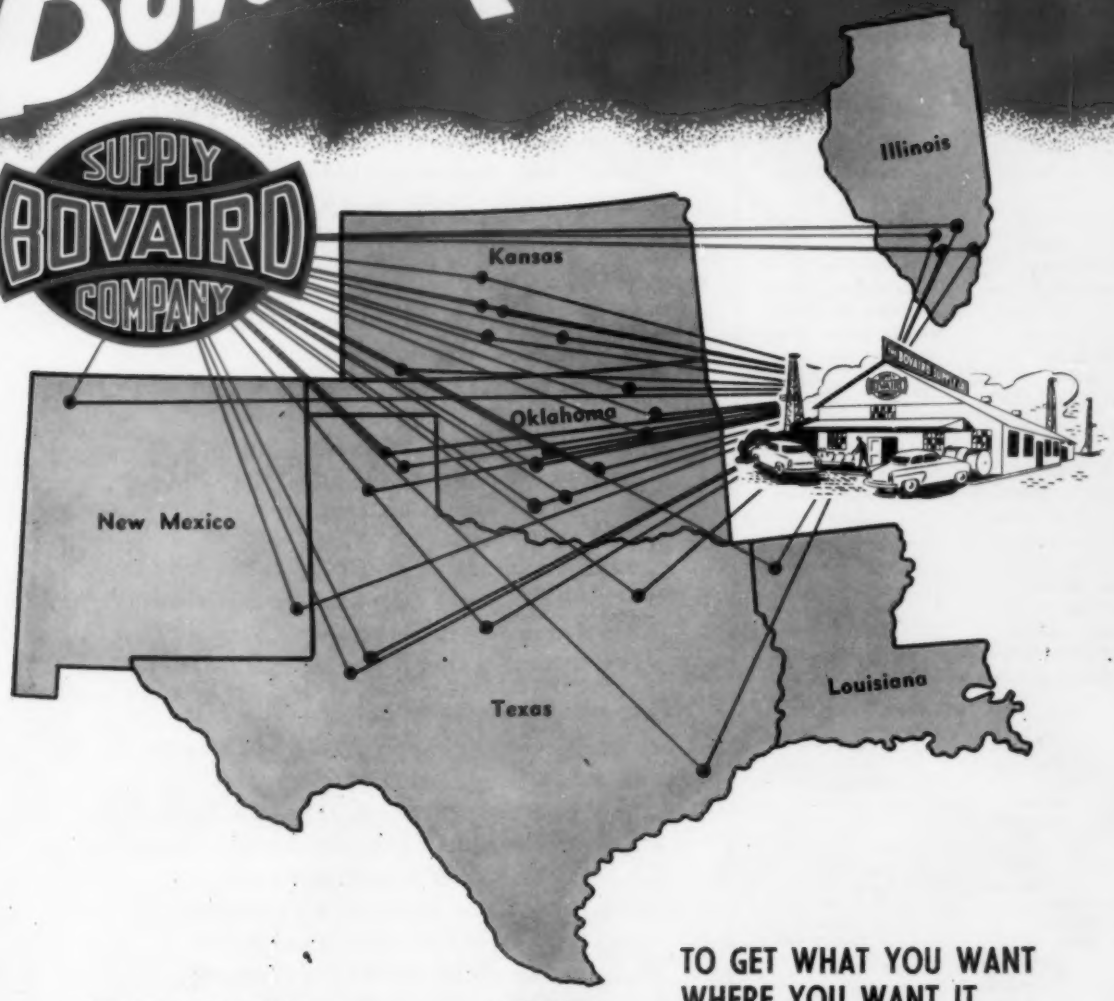

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IN THE NEWS

General Interest:

Hearings Show Imports Falling, But Not Fast Enough 65
Demand to Stay Put in '58, Then Rise 71
Colorado May Increase Its Oil-Industry Taxes 73
Hurricane Esther Chases Gulf Operators to Shore 74
Fifth World Congress Scheduled for New York in '59 90

Pipelining:

Tool Eliminates Cracking at Joints While Laying Pipe 70
Trans-Canada Gas Moves to Winnipeg This Week 73
Gas Lines Busy in Fiscal Year, FPC Report Shows 79
Pipeline Briefs 80
Producers Hit Pipelines in Brief Filed With Texas Agency 80
Big Pipe on Way for Texas-to-Florida Gas Line 80

Production:

Cardwell's New Mud Pump Is Light, But Powerful 68
B.A. Sets Production Depth Record in Oklahoma 70
Texas Slashes Allowable to Record Low of 12 Days 71
R.&B. Completes Deep Offset Below 19,000 Ft. 71

Drilling and Exploration:

Texas' Deepest Hole Nears 20,500 Ft., May Go Deeper 69
California to Lease Big Offshore Area 76
Wild Well Bolsters Michigan Hopes for Trenton Pay 78
Jersey Standard Seeks Exclusive Iranian Concession 78
Sun Group Has Strike in Lake Maracaibo 87
Bolvia Set to Name Winner of Big Concession 88
Israeli Firms Abandon Greek Island Search 89
Wildcat Prospects Are Plentiful in Wyoming 171
Charts for Analyzing Oil-Prospect Costs 172
Gas Play Hits North Appalachians 175
Oklahoma Sees a Big Wildcat Surge 183

Processing:

General Petroleum Eliminates Steam Over Coker 67
O.C.A.W. Local Backs Home-Care Hospital Plan 72
Processing Briefs 75
Refiners Hit Military's Foreign Jet-Fuel Contract 78
Conoco Opens Atomic Research Lab in Oklahoma 82
Amoco Ends Experiment to Get Fuel From Air and Gas 84
Stanvac, Filipinos in Race for Philippine Refinery 87
British Plan Sharp Increase in Refining Capacity 89
California Standard Deals for Hawaiian Refinery Site 89

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TECHNOLOGY—OPERATION

Refining-Processing

How Isotopes Work For Refiners **91**

By George Weber

Radioactive isotopes are taking on added importance in refineries. They have emerged from the laboratories and are now used in a wide number of applications in routine processing and maintenance. However, common application is largely restricted to the major oil companies. Since radioisotopes are neither expensive nor dangerous, their potential application in all sizes of refineries is so promising that they should receive attention from the whole refining industry.

Dehydrating Natural Gas With Glycol **106**

By L. D. Polderman

Here are operating data from 10 plants representing 55 plant-years' of service using diethylene-glycol dehydrating units. Performance has been entirely satisfactory to date.

G. P.'s Torrance Plant Will Boost Reforming Capacity **112**

A new catalytic reformer (Sovaformer) will soon go on stream at General Petroleum Corp.'s Torrance, Calif., refinery. The unit will be rated at 12,000 bbl. of naphtha feed per day.

The Foreman's Page **129**

Questions on Technology **133**

Drilling-Production

What It Costs To Drill Wells in California **101**

By R. C. Sharp and John J. LaBouff

A two-part article in which a drilling contractor and an oil-company representative voice their respective views. Operating costs increased from $800 per day for a typical well in 1948 to $1,128 per day in 1956.

Dehydrating Natural Gas With Glycol **106**

By L. D. Polderman

On The Job . . . In The Fields: Calculating Water-Flood Costs **113**

Convenient charts provide a rapid method for finding the costs of water for flooding an oil reservoir. Results are in dollars per acre and in cents per barrel of oil produced.

Adena Field Goes to Updip Water Injection .. **121**

By J. O. Scott

Because of the geology of Adena field in Colorado's Denver-Julesburg basin, a new water-flood program calls for updip injection from the oil. Recovery will be upped from 41 million barrels (primary recovery) to 71 million barrels.

Pipelining

Pipeline-Flow Efficiency Testing **114**

By R. F. Bukacek and R. T. Ellington

Part 2 of a three-part series. In this installment, the equations required for calculating flow efficiency are presented and discussed and their use is illustrated in a sample calculation.

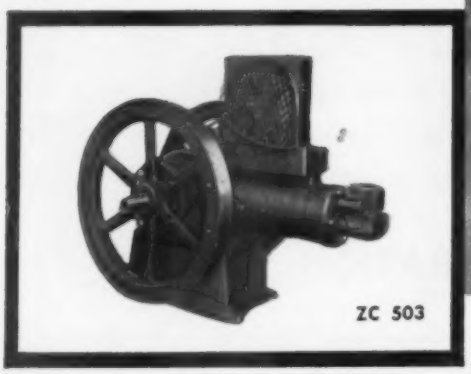
Pipeline Patrol: Four Corners Line Moves Ahead **137**

By Ed McGhee

Spreads are clipping off 2 miles per day each, as pipeliners work through loose sand and solid rock of the remote Four Corners area. When line is completed, two pressure-reducing stations will be built to offset effect of elevation drop.

DEPARTMENTS

They Say	46	Questions on Technology	133	Statistical Summary	188
Calendar of Events	51	Pipeline Patrol	137	Drilling Statistics	189
Journally Speaking	59	Drilling Contractors	143	Supply Statistics	190
Editorial	61	New Equipment	146	Refining Statistics	191
Watching Washington	69	Equipment Men in News	164-197	Markets	192
International News	86	Exploration Highlights	171	Classified Advertising	193
Foreman's Page	129	Personals	185	Advertisers' Index	197



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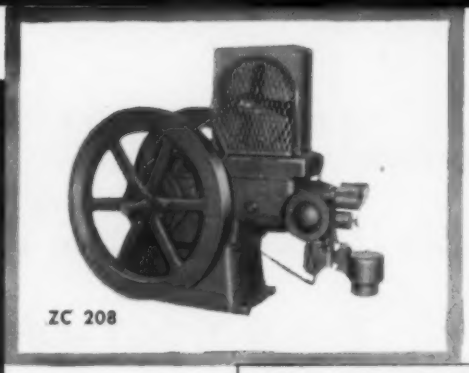

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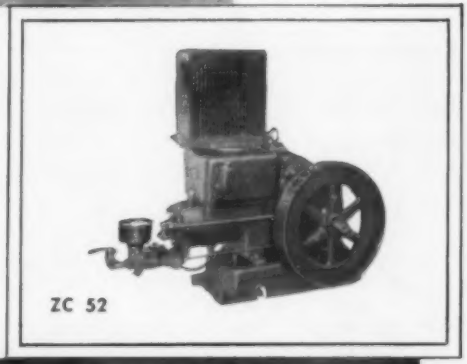

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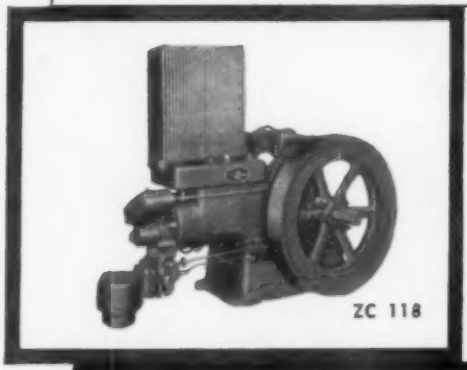

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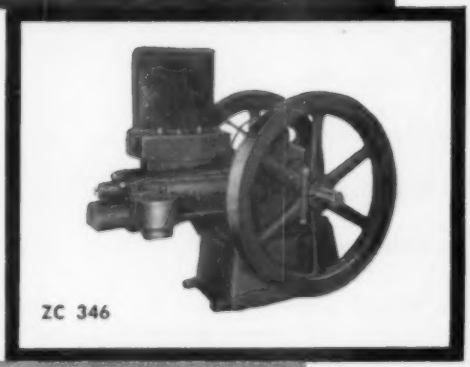

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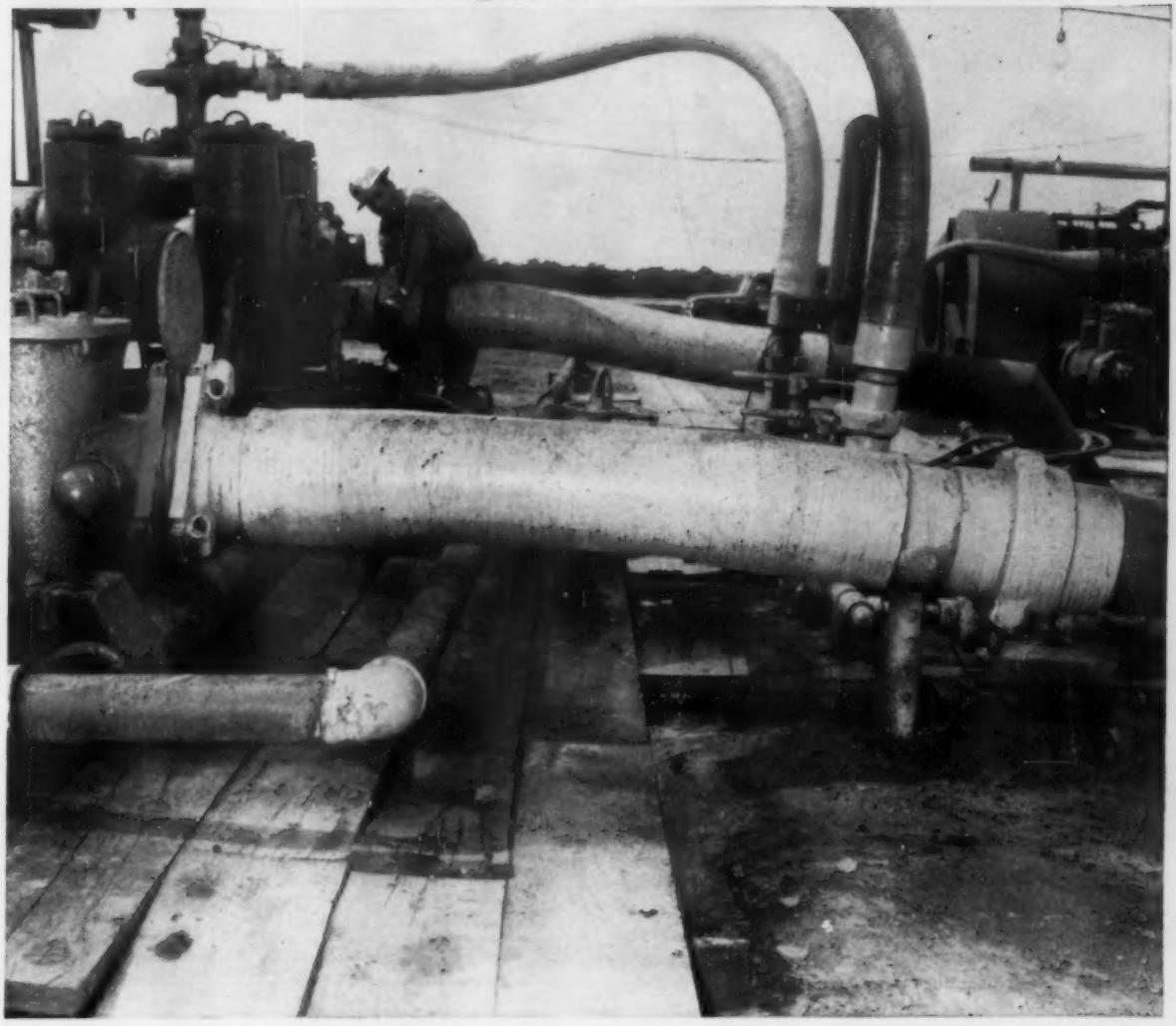

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Hot Water—Clear	Cup Type	Bronze or Stainless	Cast Iron	Wing Guided Bronze
Salt Water (Bronze End)	Cup Type	Stainless Steel	Cast Iron	Wing Guided or Slush Pump Type Stainless
Crude Oil	Cast Iron Snap Ring	Steel or Stainless Steel	Cast Iron	Wing Guided Bronze or Stainless
Gas Oil	Cast Iron Snap Ring	Steel	Cast Iron	Wing Guided Bronze or Stainless
Kerosene	Cast Iron Snap Ring	Steel	Cast Iron	Wing Guided Bronze or Stainless
Gasoline	Cup or Follower Types with Bakelite or Rock Hard Rings	Steel	Cast Iron	Wing Guided Bronze or Stainless
Acid (Bronze End)	Bronze	Bronze	Bronze	Wing Guided or Slush Pump Type Bronze
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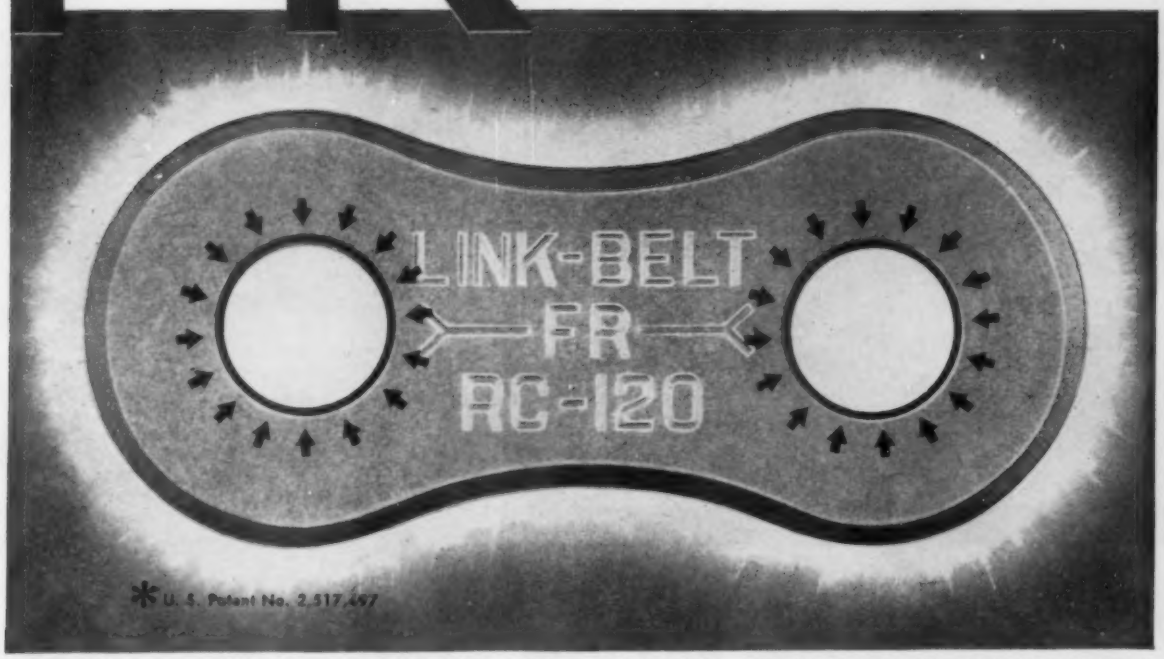

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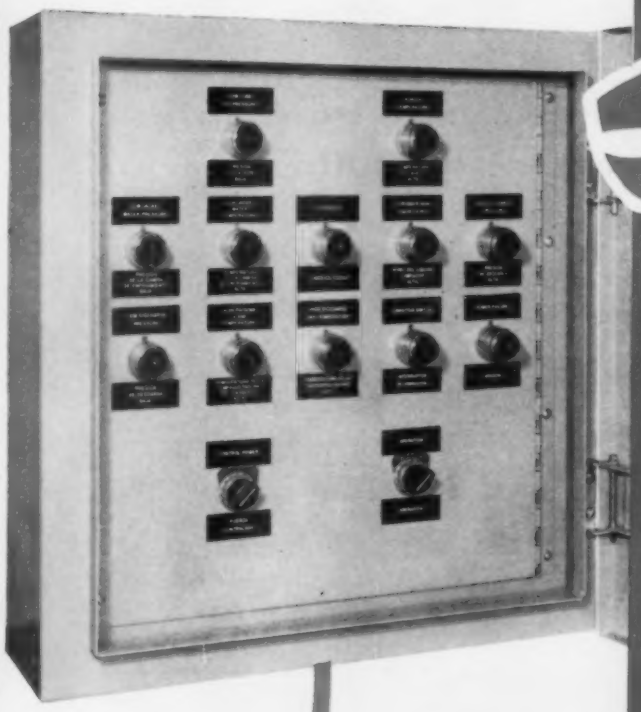

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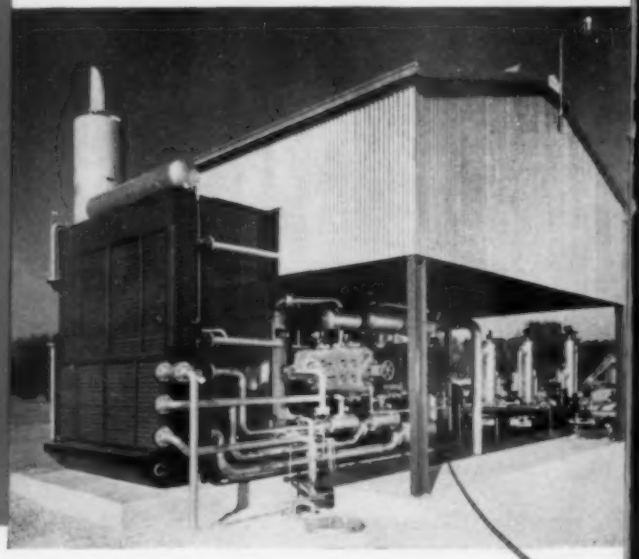

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Southwest Packaged Gas Compressors can now be furnished with automatic shutdown and panelboard indicator equipment custom built to the particular requirements of your station.

Any combination of automatic shutdowns, working through a solenoid controlled valve in the fuel gas system, protects your engine against malfunction.

During normal operation, the signal lights on the panelboard remain off. When any one control switch becomes actuated due to abnormal operation, the signal light corresponding to that switch goes on. The engine shuts down automatically. All other relays are locked out, and the one signal light remaining on indicates the exact switch which caused the engine to shut off.

FOR GAS LIFT, GAS BOOSTER, PRESSURE MAINTENANCE AND SIMILAR PROJECTS.

As many as fifteen separate functions can be pinpointed by this panel indicator. Your maintenance men can get your compressor back on stream faster.

Southwest engineers will give you full details on this protective equipment for unattended compressor operation.

This is another development by Southwest to improve the operation of Packaged Gas Compressors.

SOUTHWEST INDUSTRIES, INC.

Post Office Box 19392, Houston 24, Texas

On 4 counts...a better buy

1. Biggest crawler value in its class! For a tractor in the under-25 h.p. class, choose the value leader. The new OC-4 is designed specially for industrial service with heavy-duty construction throughout. Here's dependability, less service worries, longer life.

2. New 4-speed transmission—For peppy "get up and go" you can't beat the OC-4. Speeds range from 1½ m.p.h. for the heavy work to 5¼ m.p.h. for the long hauls. A big 9" clutch gives you smooth operation all the way. The ideal, compact, easy-maneuvering dozer unit for pipeline work, etc.

3. New, longer crawler track—With an 11% increase in ground contact you get greater stability, more traction than ever. Higher flotation, too, for work in soft ground. Works with dozer, Angleblade, pipe handling boom, winch, etc. Also available is the OC-46 with wider tracks for service with loader and Jet-Trencher.

4. New operating ease—It's easier. Simple controls are conveniently grouped. No stretching or tugging. Physical effort is cut to a new low. New box-type seat and low silhouette assure the operator comfort and visibility to do a bigger day's work every day.

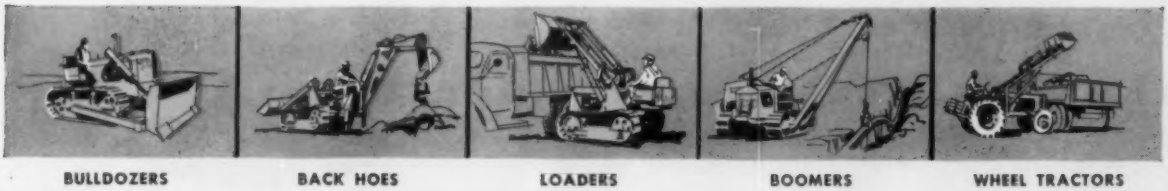
The new OC-4 will cost you less to own, less to run, less to maintain. Your Oliver distributor has complete details. See him, or write us for literature.

OLIVER

THE OLIVER CORPORATION

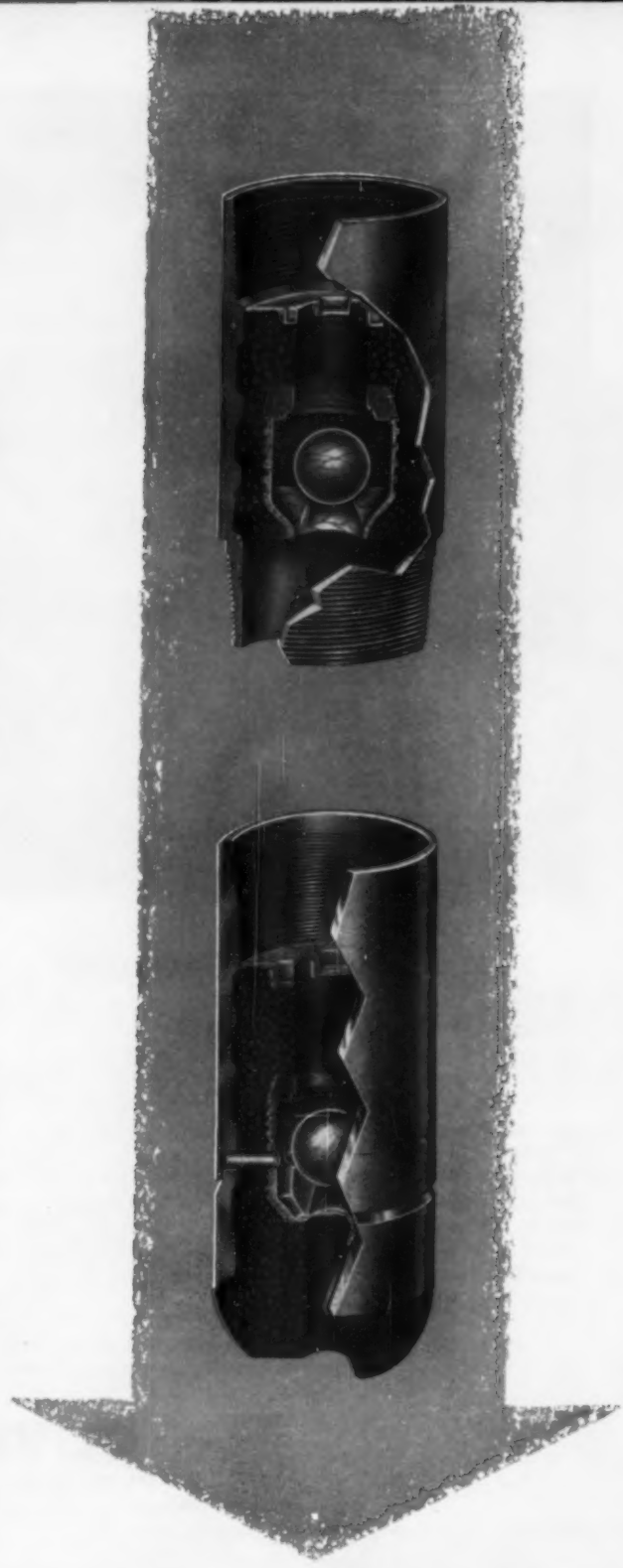
400 West Madison Street, Chicago 6, Illinois

a complete line of industrial wheel and crawler tractors and matched allied equipment



BULLDOZERS | BACK HOES | LOADERS | BOOMERS | WHEEL TRACTORS

Put the BEST on Bottom



The preponderant use of Larkin Floating and Guiding Equipment is a natural result of its years of dependable performance. Experience brings confidence--and that's why thousands upon thousands of wells each year are cemented through Larkin Equipment.

LARKIN PACKER COMPANY, INC.
WAXAHACHIE, TEXAS

LARKIN
...Through Your Supply Store

PESA

LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

IMPROVED SHELL LPI PROCESS FOR BUTANE ISOMERIZATION IS 5 WAYS BETTER

Shell's Liquid Phase Isomerization
makes it more economical than ever to
convert n-butane to isobutane

NEW PROCESS SCHEME MEANS:

1. highest conversion of any known process
2. lower process plant cost
3. high flexibility—with minor addition can isomerize n-pentane
4. high stream factor
5. lower cost of isomerizate fractionation

For technical details and cost estimate, see your engineering contractor. LPI process is licensed by Shell Development Company, 50 West 50th Street, New York 20, New York.

SHELL DEVELOPMENT COMPANY

ACE IN THE HOLE for CABOT owners

Seldom does a Cabot need service. Yet, any J&L Supply man in the United States or Canada can trigger fast, interested help for a Cabot owner in trouble. Cabot itself stands by 24 hours a day with parts and well-head service maintained exclusively for J&L customers.

Buy your Cabot with confidence. It was built to outlast the field, but your ace in the hole is J&L service.

This Equalastic® Evener Bearing is patented, never needs lubrication, and is covered by an interesting and exceptional Warranty Policy significant of Cabot quality in every detail. Ask for latest specifications bulletin.

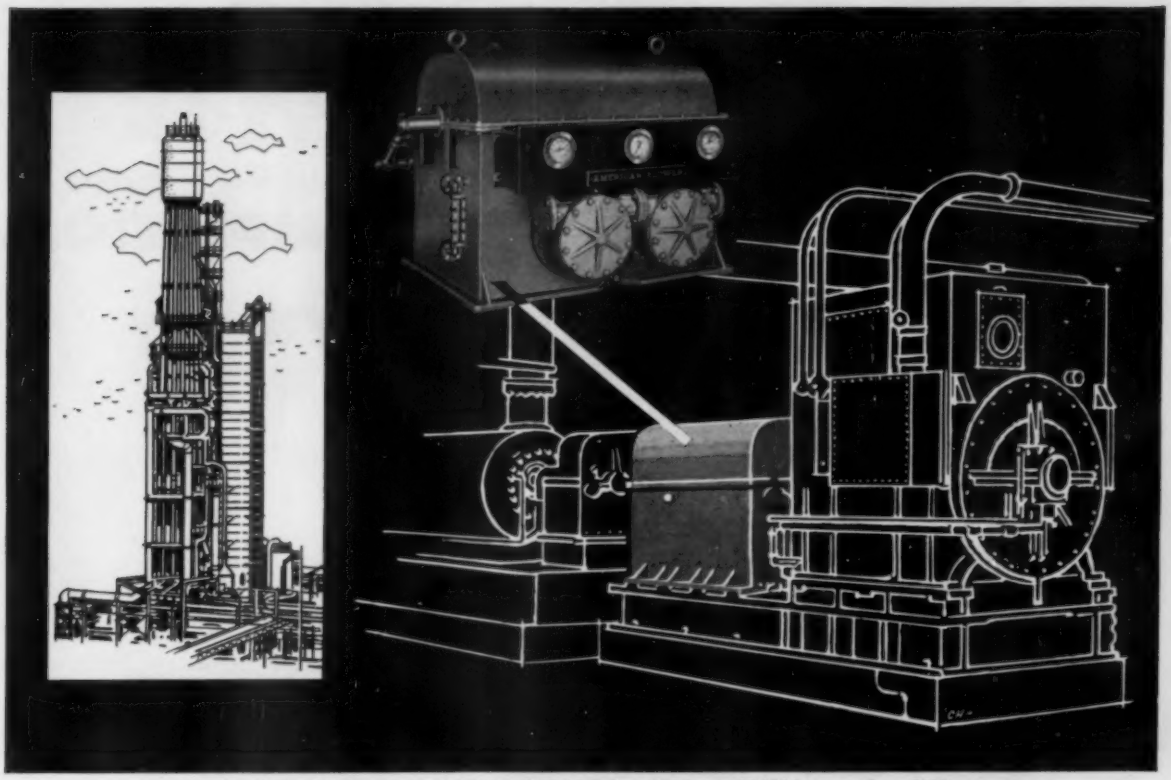
Jones & Laughlin

SUPPLY DIVISION – Tulsa

J&L – A GREAT NAME IN SUPPLIES

40

AMERICAN BLOWER *Gýrol*® FLUID DRIVE . . .



Class 4 and Class 6 (shown), Type VS Gýrol Fluid Drives, 100 hp to 12,000 hp, speeds to 3600 rpm.

Here's how accurate pump and compressor control solves varying flow problems at refineries

Problem: how can refineries simplify and control the flow of gases and fluids of various densities and temperatures? Solution: an American Blower Gýrol Fluid Drive that permits smooth, shockless speed and torque adjustments between motor and load!

Catalytic reforming processes – You can vary the flow rates of pumps and compressors of all sizes and types – as needed – with the adjustable-speed feature of the Gýrol Fluid Drive. What's more, the Gýrol unit simplifies starting equipment, even provides no-load starting.

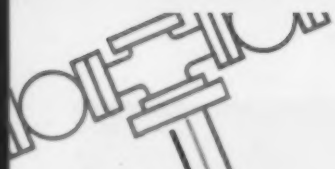
Centrifugal and positive displacement pumps – The combination of a Gýrol Fluid Drive and a constant-speed induction motor provides stepless, adjustable speed for flow control of centrifugal and positive displacement pumps – without throttling valves! You get the same flexibility and adjustable flow as obtained with a steam turbine.

Catalyst rejuvenators – Gýrol Fluid Drives are a big help to this and other refining operations requiring high-inertia starts. The smooth, shockless power transmission satisfies tough drive requirements; lets you engage the load with engine at full rpm, or permits across-the-line starting of normal-torque, general-purpose motors.

Call your American Blower branch office for full information, or write American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ont.

AMERICAN BLOWER

Division of AMERICAN-Standard



P·R·I·M·E

COMPLETIONS

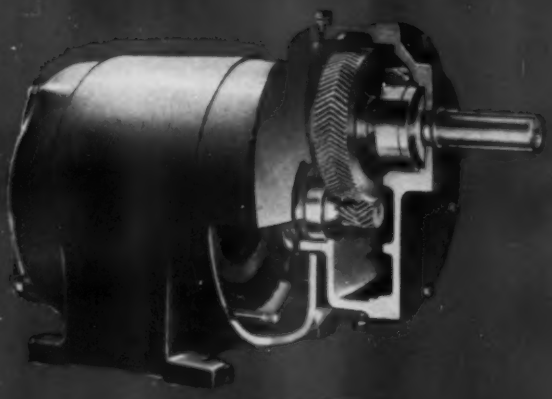
BY BROWN

Parallel
Retrievable
Independent
Multiple-string
Equipment

PARALLEL STRING COMPLETION

Brown Oil Tools has several different types of retrievable parallel string packers for both dual and triple installations . . . tailor-made and field-tested for specific well applications. *For our new catalog on parallel string completions contact your Brown representative. Or write Brown Oil Tools, Inc., 8490 Katy Rd., Houston, Tex.*

BOT
BROWN
OIL TOOLS, INC.



SINGLE REDUCTION
Parallel Shaft Type

MASTER -1st Choice for GEARMOTORS

Because...

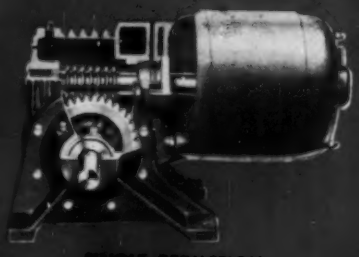
...With five types of parallel and right angle Gearmotors, Master has the flexibility and choice of design you need for selected output speeds.

...With electric motor and gears combined into a compact, integral power unit, you reduce costs and increase efficiency through elimination of belts, couplings, chains, sprockets, external bearings or separate reducers.

...Available in sizes from 1/8 to 125 H.P. You can integrate with the gearmotor electric brakes—3 types of variable speed units and fluid drive in any combination.

...And that's why more gearmotors carry the Master name than all other makes combined. Write on your business letterhead for details.

DOUBLE REDUCTION
Parallel Shaft Type



SINGLE REDUCTION
Right Angle Shaft Type

THE MASTER ELECTRIC COMPANY

Dayton 1, Ohio

ANOTHER SUPERIOR

EASTMAN SERVICE

EASTCO SELF-CHECKING DRIFT INDICATOR

Actual Size Drift Indicator Disc

Smallest, most accurate Drift Indicator on the market . . .

Self-checking and economically operated. Perfected through years of engineering research and design development. It is one of the smallest, most accurate mechanical indicators on the market. The patented self-checking features make two successive recordings to guarantee the operator an accurate recording.

Let an Eastman Sales Engineer nearest you demonstrate how easy and economical this instrument is to use. CALL EASTMAN TODAY.

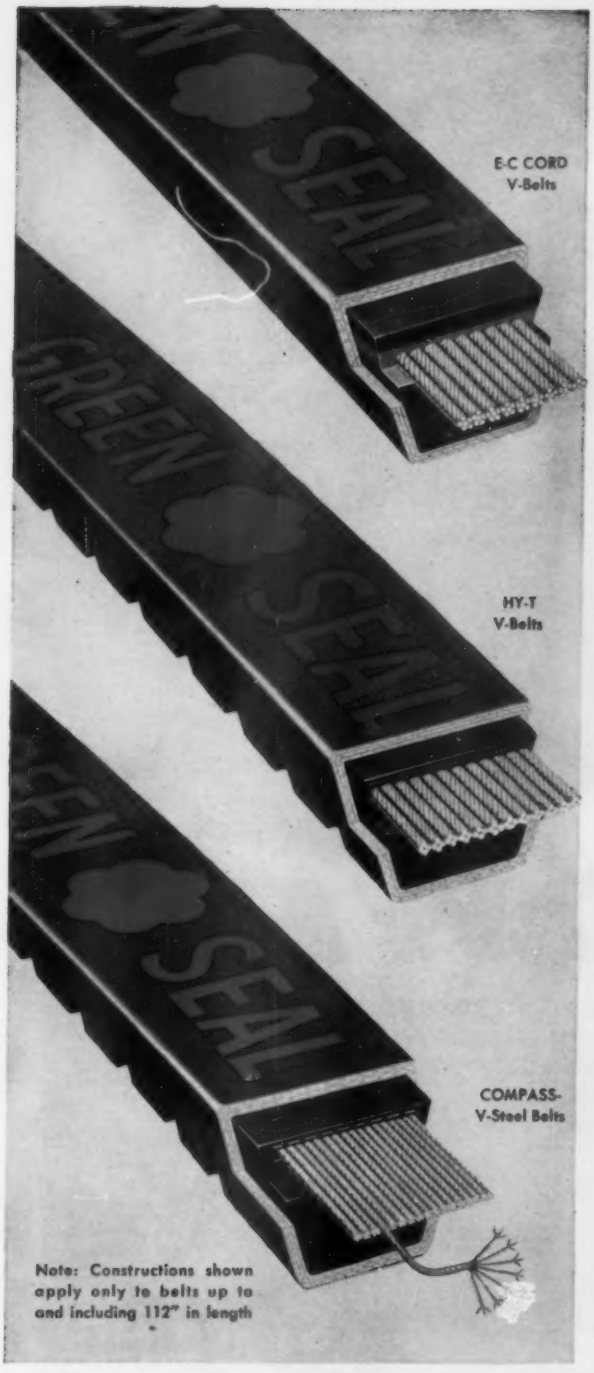
ACTUAL SIZE
Length: 10″
O.D.: ⅞″

EASTMAN

EASTMAN OIL WELL SURVEY COMPANY
LONG BEACH • DENVER • HOUSTON • CALGARY

EASTMAN INTERNATIONAL DIVISION
For Export Write
P. O. BOX 1500 DENVER 1, COLORADO, U.S.A.

DIRECTIONAL DRILLING . . SIDETRACKING . . . OIL WELL SURVEYS



Why V-Belts with the Green Seal?

The Green Seal is put on each Goodyear multiple V-Belt for *your* protection. For it's your sign of a belt with dimensional stability—something long sought but only recently achieved in a complete line of V-belts.

What does dimensional stability mean to you? It means belt length remains the same from factory to drive. The length you order is the length you get. Matched sets stay matched. And mismatching – the biggest problem in belting multiple drives – is now a thing of the past.

How was this dimensional stability achieved? Until recently, stable belt length was possible only with steel cable load carriers as developed by Goodyear. But now it is also accomplished with synthetic cord through the exclusive Triple-Tempered 3-T process that stabilizes length by careful tempering with Tension, Temperature and Time.

Triple-Tempering also gives you a stronger, more shock- and stretch-resistant belt. Add "balanced construction" – with each component of the belt designed to its job—and you have a smoother-, longer-running belt which means maximum, trouble-free horsepower hours at minimum cost.

DIMENSIONALLY STABLE V-BELTS
with the GREEN SEAL by

GOODYEAR

THE GREATEST NAME IN RUBBER

The Goodyear Tire & Rubber Company, Dept. 794, Akron 16, Ohio

Please send me more information about how V-Belts with the Green Seal solve the major problem in belting multiple V-belt drives.

Name_____

Company_____

Street Address_____

City_____ **Zone**_____ **State**_____

Compass, E-C Cord, Hy-T, Green Seal—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

AMERICAN IRON
UNIVERSAL "55"
FRICTION CATHEADS

EXTRA POWER

. . . to makeup and breakout any connection!

ON LARGE or small drawworks, American Iron Universal "55" catheads deliver that EXTRA POWER needed to properly makeup or breakout ANY size tool joint connection!

These advantages make the Universal "55" a truly *universal* cathead:

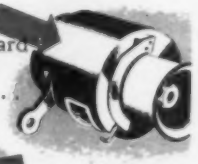
- Most powerful cathead in the field . . .
- Simple and quick installation . . .
- Spin and tong with the same makeup cathead . . .
- Available with air or manual controls . . .
- Smaller overall dimensions . . .
- Removable steel spool increases road clearance.

Available through your Supply Store

Ask any American Iron representative to show you the 10-minute presentation of "THE CATHEAD YOU CAN DEPEND ON."

EXTRA SAFETY!

Safety stationary guard (encloses all mechanism) . . .



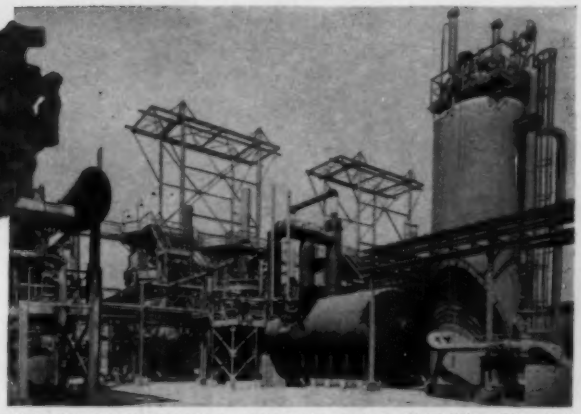
Rope divider is mounted to the safety guard . . .

AMERICAN IRON & MACHINE WORKS CO. INC.
MANUFACTURERS OF OILFIELD EQUIPMENT
A
OKLAHOMA CITY

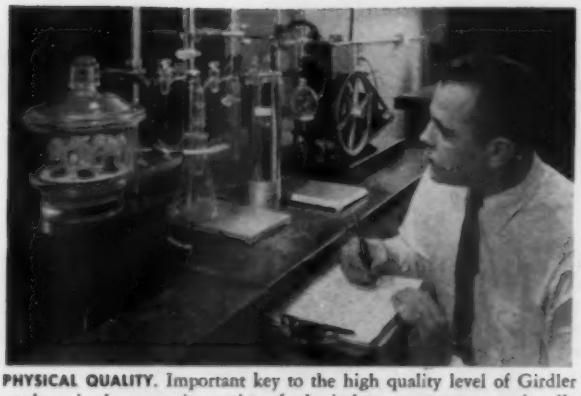
AMERICAN IRON & MACHINE WORKS COMPANY, INC.—Oklahoma City, Okla.—Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

Performance exceeds claims for G-29 steam-hydrocarbon reforming catalyst

THIS IS G-29. A nickel base catalyst containing approximately 27% nickel. For reforming of hydrocarbons at temperatures of 1100°F to 1850°F in production of ammonia and methanol synthesis gases, hydrogen, OXO synthesis gases, controlled atmospheres, carrier or utility send-out gases.



USED IN ADAMS TERMINAL AMMONIA PLANT of Phillips Chemical Company. Girdler catalyst specialists studied the production of ammonia synthesis gas in secondary reformers. Cooperating with Girdler, the Phillips Chemical Company ran pilot plant tests and selected G-29 catalysts for this application. Results: Catalyst performance exceeds Girdler claims. *Methane in reformer effluent is less than 0.1 mol percent at normal operation.*



PHYSICAL QUALITY. Important key to the high quality level of Girdler catalysts is the extensive series of physical measurements continually being applied to them . . . to show such properties as surface area, pore volume, particle size, shape and density, crystal structure. Test shown is for pore volume.

YOUR PROBLEM? Girdler's Research, Development and Technical Service groups combine sound scientific theory and extensive commercial experience in the solution of catalyst problems. This know-how and Girdler's continuing program of product improvement, high quality control standards, and a keen appreciation of customers' catalyst problems can help you.

Write for free bulletin No. GC 1256, cataloging Girdler's full line of catalysts.

CATALYST DEPARTMENT

The GIRDLER Company

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

LOUISVILLE 1, KENTUCKY

Girdler Manufactures Catalysts for: Hydrogenation • Synthesis Gases and Hydrogen Generation • Desulfurization • New Catalytic Processes

Now, another leading European manufacturer will build **IDECO** oilfield equipment . . .

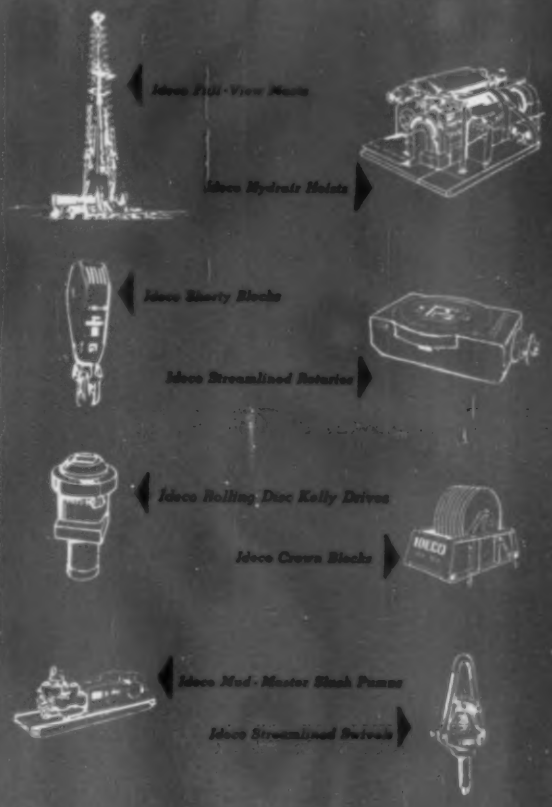
SCHOELLER-BLECKMANN, Vienna, Austria licensed to manufacture IDECO'S complete line

Now, to meet the ever-increasing demand for Ideco equipment in the growing oil industry of Europe, and to make it more convenient to make capital purchases in local currency Ideco is pleased to announce that the eminent Austrian manufacturer, Schoeller-Bleckmann, has been licensed to manufacture Ideco products in Austria.

Through its European affiliate, Dresser A. G., and with the many advantages of Dresser Industries' worldwide operations, Ideco is steadily increasing its ability to serve the many operators in Europe who prefer the reliability and economy of modern, field-proven Ideco equipment.

Schoeller-Bleckmann, with almost a century of manufacturing experience, is well qualified to maintain the high standards of Ideco quality. Founded in 1862, Schoeller-Bleckmann has made many contributions to the development of high grade steels. The company now operates three plants employing 6,000. Because of the excellence of their supplies and services the SBS oilfield equipment division has grown rapidly in recent years.

This new identification of Schoeller-Bleckmann with Ideco gives the extra advantage of two fast-growing, service-conscious organizations and will particularly benefit the oil industry of Austria.



Look for this symbol of progress — IDECO-SBS

IDECO | SBS

IDECO, Inc.
P. O. Box 1331 • Dallas 21, Texas
Republic National Bank Building

SBS:
Schoeller-Bleckmann
Steelworks Ltd., Vienna, Austria

Dresser, A. G., Muehlebachstrasse 43, Zurich, Switzerland

Did You Ever See a Double Headed Pump?

This unusual installation is operated by Low-Cost Utility Electric Power

Pumping from different depths but through the same casing, these pumps can be operated simultaneously or singly. Each is operated by AUTOMATICALLY CONTROLLED push-button power – ELECTRIC POWER.

While such installations are not common, it is standard procedure in most fields today to utilize Utility Electric Power because of the overall LOWER COST, greater efficiency, and numerous special benefits.

For helpful counsel on how you can benefit, call the Power Engineer of your Utility Electric Service Company.

I'm LCP – Low-Cost Power
ON THE JOB – 24 HOURS DAILY.

PETROLEUM ELECTRIC POWER ASSOCIATION
P. O. BOX 2771 DALLAS. TEXAS

*Trouble-Free ROSS EXCHANGERS

protect Western Gear Units along 65-mile pipeline

A recently completed 65-mile California pipeline linking the Santa Paula-Ventura fields to Wilmington now carries crude petroleum formerly transported by coastal tankers. Pictured above is the Western Gear Speed Increaser at the Ventura station, one of four units along the route.

For continuous temperature safety of gears and bearings, all four Western Gear units are equipped with Ross Type BCF Exchangers. Heat generated by power transmission is effectively carried away, and ample supplies of properly cooled lube oil are provided to vital moving parts at all times.

*Says Western Gear Corp., "We have never had any trouble with Ross Exchangers over a period of many years. They adapt themselves ideally to our gear boxes, and your company provides excellent engineering assistance in determining the correct exchanger for the job to be done."

Repeatedly chosen for their rugged dependability as well as their high thermal efficiency, Ross Exchangers are used extensively throughout the oil and gas industry to meet heat transfer requirements for lube oil, jacket water, air and hydraulic fluid.

Easy to install, these compact units are pre-engineered and fully standardized in a broad range of sizes. For detailed information, request Bulletin 1.1K5. Ross Heat Exchanger Division of American-Standard, Buffalo 5, N. Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

ROSS HEAT EXCHANGER

Division of American-Standard

Here's where offshore drilling cut its teeth 47 years ago

The first successful overwater drilling in the United States was on Caddo Lake near Mooringsport, La., 1910.

Pirogues instead of power boats, cypress logs instead of submersible barges, cross timbers instead of mobile steel platforms, yet this first operation "alligator" was a success. The field is still producing.

Obstacles have never proved much of a barrier to you oil operators in your search for new reserves. Through hard work and ingenuity you usually achieve what you set out to do . . . and the PESA manufacturer-service-supply company team is ready, willing, and able to back you up.

Each of the giant offshore platforms . . . with its attendant drilling tenders, helicopters, supply barges, and permanently installed equipment . . . is proof beyond any doubt of the desire and ability of the members of the Petroleum Equipment Suppliers Association to meet the needs of oil operators, wherever you drill.

*
PETROLEUM EQUIPMENT
SUPPLIERS ASSOCIATION

57-101

PROUD TO BE PART OF A PIONEERING INDUSTRY

Yardstick

FOR DOWNHOLE ACCURACY

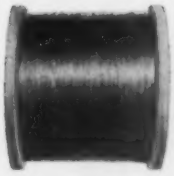
The oil industry's first special measuring device was pioneered by Halliburton over 30 years ago. Continuous engineering and development since has enabled Halliburton to maintain leadership in this field . . . and Halliburton's present-day equipment is unmatched for accuracy, efficiency and variety of selection.

Halliburton's Standard, Heavy Duty and Extra Heavy Duty Type Measuring Assemblies can be operated by hand, or driven by gasoline or diesel power, rear wheel of autos, or cathead operation. The unusually accurate Veeder Counter practically eliminates guesswork and miscalculation because it reads exact depths in either feet or meters.

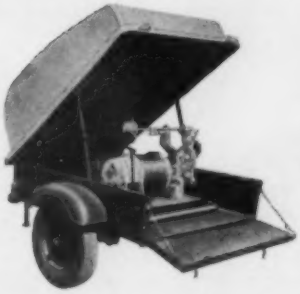
Whatever your measuring requirements, Halliburton has the right device or combination of equipment to meet them. A Halliburton representative will be glad to help you analyze your needs.

HALLIBURTON OIL WELL CEMENTING COMPANY

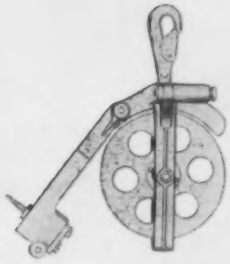
DUNCAN, OKLAHOMA



MEASURING LINES... various lengths up to 25,000 feet, available in diameters of .066", .072", and .092". Three different types; 1. Regular-black, non-coated steel; 2. Galvanized-coated steel, impregnated; 3. Stainless-steel for wells containing hydrogen sulphide.

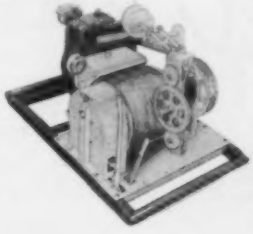


TWO-WHEEL TRAILER... with ample space for even the largest Halliburton Power Driven Measuring Assembly. Specially designed for portability over rugged terrain. All-steel construction. Overall length of 105". Recommended carrying capacity of 1,500 lbs. Metal cover is optional.

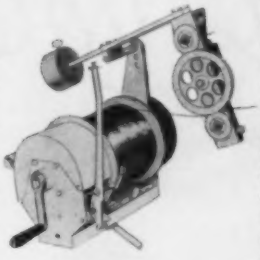


LATCH TYPE HAY PULLEY AND LINE WIPER... required for running measuring line in open holes, drill pipe, tubing or casing. Safety plus speed are provided by iron latch type guard and frame. Measuring Line Wiper is optional, cleans line as it is retrieved.

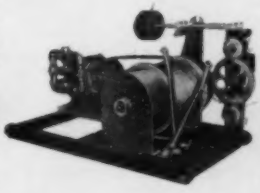
STUFFING BOX AND STAFF ASSEMBLY... specially designed for measuring operations in open hole or casing while well is shut in under pressure up to 15,000 psi. Safer operating due to aluminum line guard and frame. Variety of models for different diameter Measuring Lines.



POWER-DRIVEN MEASURING ASSEMBLY (Extra Heavy Duty Type—Standard)... is capable of safe, efficient measuring in even the deepest wells. All controls, clutch, and brake levers grouped for easy operation. Driven by a 1-cylinder, air-cooled gasoline engine with gear reduction Power Take-off. Also available with 9.2 h.p. gas engine with twin disc clutch Reel.



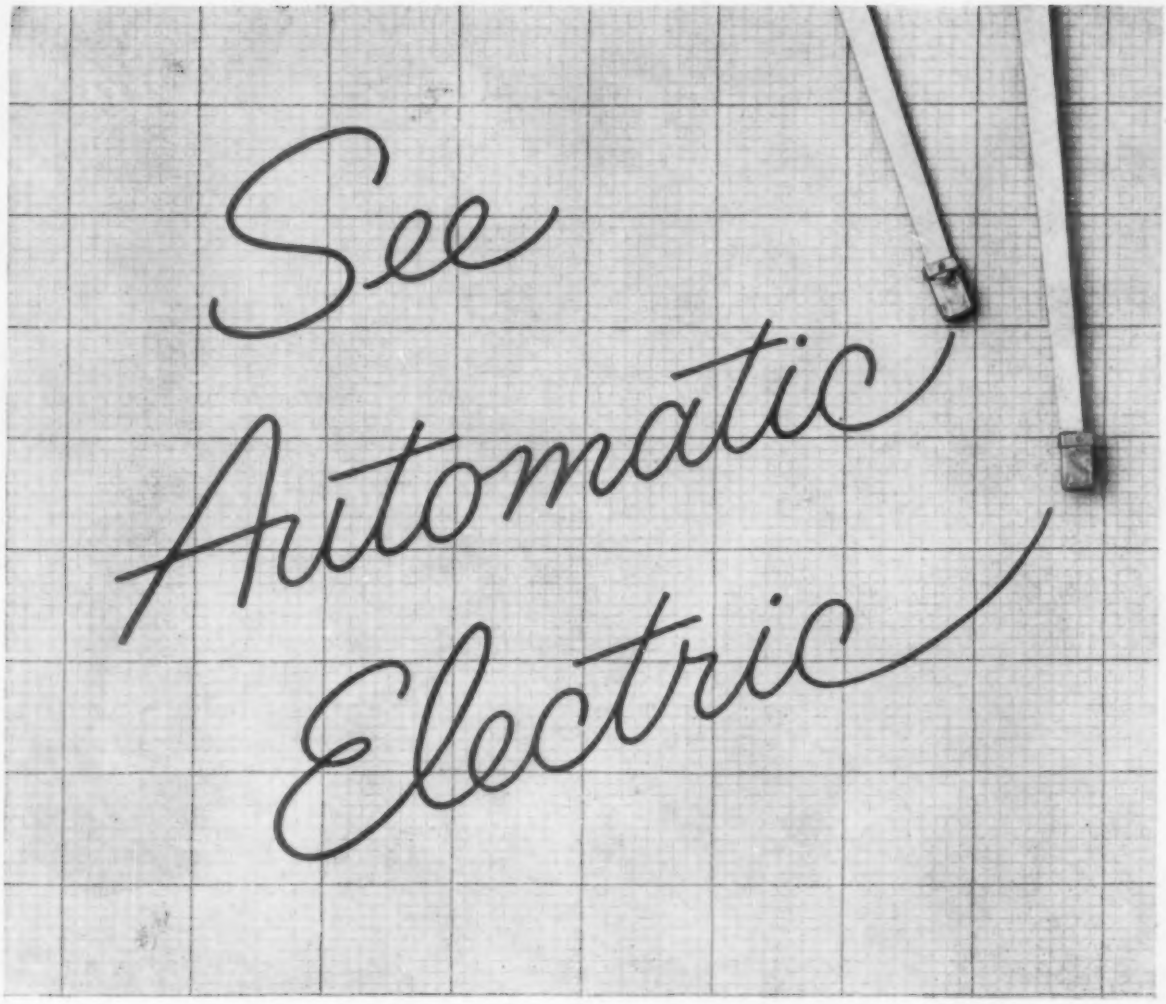
HEAVY DUTY MEASURING DEVICE... for measuring requirements, surveys, etc., where well depths are greater than line capacity of reel with Standard Measuring Device. Can be mounted to Jack Post on Rotary Rig for manual or "cathead" operation.



AIR POWERED MEASURING ASSEMBLY... driven by compressed air power for extra safety and flexibility. Especially suited for well measurements where there is a need for high starting torque, accurately controlled variable speed, or where a possible fire or safety hazard exists. Air motor used is a radial 5 cylinder unit with built-in gear reduction.

HALLIBURTON **MEASURING EQUIPMENT**

251 SERVICE CENTERS • JUST MINUTES AWAY FROM YOUR WELL



-for telemetering and remote control circuits

LENKURT CARRIER *equipment is engineered, furnished and installed by Automatic Electric. Lenkurt Type 51B Carrier is specially engineered for dependable control of remote stations.*

Will you have to put up new poles and wires to add the circuits you'll need for telemetering and remote control?

"Probably not," say Automatic Electric engineers who specialize in petroleum industry communications. "Most oil companies can add all the circuits they need *right on their present wires!*"

Using Lenkurt Carrier equipment, Automatic Electric can add new circuits by the dozens to your present network. These new circuits enable you to add automatic controls as fast as you're ready. And . . . they can be used for fast expansion of your telephone network as well.

Leading oil companies—and we've served dozens of them—find it pays to turn their communications problems over to Automatic Electric. Our specialized experience can help your company, too. For complete information, just drop a line to Automatic Electric Sales Corporation, Northlake, Illinois.

AUTOMATIC ELECTRIC

A member of the General Telephone System—
One of America's great communications systems

GENERAL TELEPHONE SYSTEM

SAVE 2 WAYS WITH

MARTIN RUBBER GUIDE CAGES

1. GREATER PRODUCING PROFITS *because:*

Martin Cages last much longer. The oil-proof rubber guides do the trick, by absorbing the ball peen hammer action of the hard balls. They also have superior resistance to sand abrasion. And they can be replaced.

2. GREATER PRODUCING PROFITS *because:*

Ball & Seat life is usually doubled, on the average. With the rubber guides, there is much less chattering, chipping and pitting. Ball falls true on seat. Such improvement in Ball & Seat life eliminates a lot of pulling expense.

In the last year alone, new users of Martin Cages have increased by 85%. The word is getting around. More and more economy-minded producers are learning about the advantages of the Martin Cages! . . . Manufactured in open and closed types . . . all diameters and styles. Write for John Martin Catalog No. 4 today. *Martin Cages are available through all supply stores.*

JOHN N. MARTIN

Manufacturer

9 W. BRADY • TULSA, OKLA.

a century of service

In September, 1857, Hieronymus Mueller opened a one-man gun and repair shop in Decatur, Illinois. Mueller's inventive genius and insistence on perfection gained many customers; and the shop prospered.

In 1871, Mueller was appointed city plumber. At that time, a new water service was connected to the main by drilling a hole, almost through the main, and then inserting a drive stop into the partially drilled hole with a blow of a sledge. Usually the plumber was drenched, the trench flooded. It was often necessary to shut off the main, interrupting service to other customers while the connection was repaired.

Mueller was quick to recognize the need for a better method of making service connections and, in 1872, invented and patented the original water main pressure tapping machine, which drilled a hole in the main, tapped the hole and inserted the stop — all without interrupting service and without flow of water into the ditch. A vital need of the expanding water industry had been answered — the first of many such answers through a century of service.

MUELLER today . . .

Mueller Co. looks to the future as it meets the needs of today. Mueller design and research engineers are already working on tomorrow's problems of the water, gas and oil industries. Five factories, equipped with precision machines, manned by skilled workers, manufacture quality products.

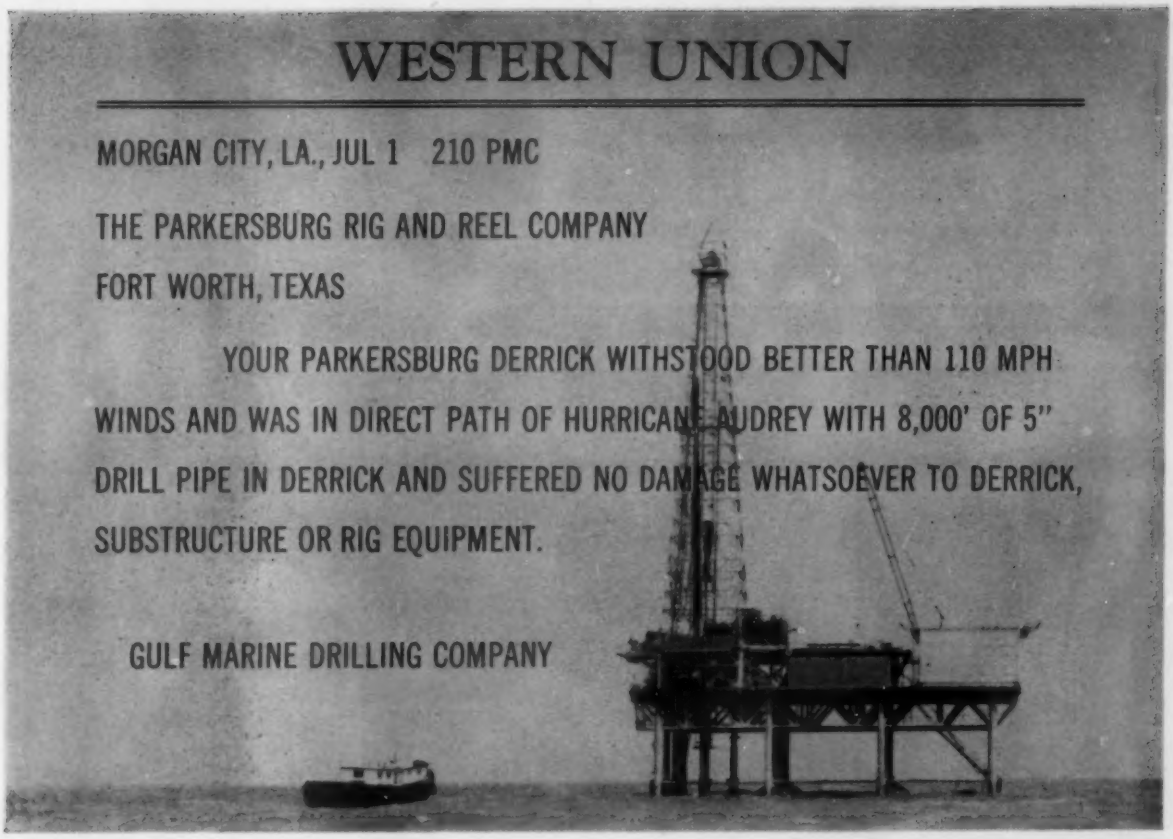
Upon the firm foundation established 100 years ago, Mueller builds for tomorrow and a second century of service to the vital water, gas and oil industries.

MUELLER CO. 100th YEAR QUALITY SERVING the Water and Gas Industries Since 1857

MUELLER CO.

DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario


WESTERN UNION
MORGAN CITY, LA., JUL 1 210 PMC
THE PARKERSBURG RIG AND REEL COMPANY
FORT WORTH, TEXAS
YOUR PARKERSBURG DERRICK WITHSTOOD BETTER THAN 110 MPH WINDS AND WAS IN DIRECT PATH OF HURRICANE AUDREY WITH 8,000' OF 5" DRILL PIPE IN DERRICK AND SUFFERED NO DAMAGE WHATSOEVER TO DERRICK, SUBSTRUCTURE OR RIG EQUIPMENT.
GULF MARINE DRILLING COMPANY

Hurricane Audrey vs. Parkersburg Galemaster

Hurricane Audrey found out what drilling rig owners have known for years — a Parkersburg Galemaster derrick is designed and built right for strength and durability. The most severe hurricane to rake the Gulf Coast since drilling rigs moved off-shore was unable to knock over the Galemaster derrick on the Gulf Marine Drilling Co. platform 20 miles off Cameron, Louisiana. Some derricks tumbled under the force of the wind but the Galemaster rode out the storm.

Get this added protection that only Parkersburg Galemaster derricks provide. There is a Galemaster in either a single well, two-well, or six-well design to suit your requirements. For gale insurance, buy a Parkersburg Galemaster derrick.

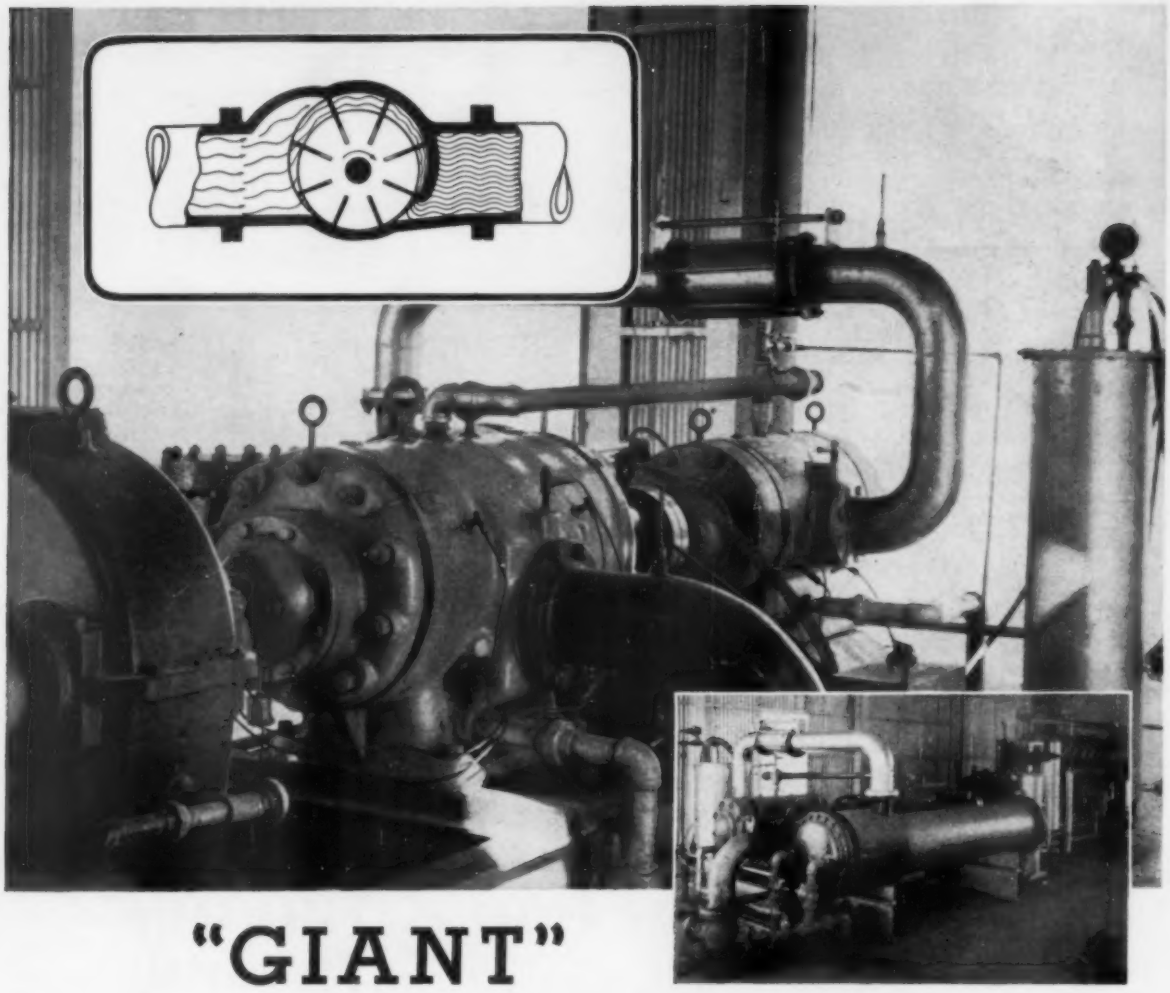
At Parkersburg, quality and service have gone hand-in-hand for 60 years!

The PARKERSBURG RIG & REEL COMPANY

DIVISION OF PARKERSBURG – ÆTNA CORPORATION

DRILLING AND SPECIALTIES DIVISION OFFICES:

P. O. BOX 1160 • PARKERSBURG, WEST VIRGINIA



"GIANT"

ANOTHER FULLER ROTARY COMPRESSOR INSTALLATION

Everything's big in Texas and compressors are no exception—not particularly in physical size but big in service!

That's why you'll find so many Fuller rotary compressors in use where trouble-free gas gathering and boosting, as well as refinery gas recirculation is demanded at low cost, peak output, with minimum attention.

Oil men know what they'll get when they specify a Fuller rotary compressor. Here are the plus features: compactness; ease of installation; elimination of valves, crank-shafts, pistons, and other moving parts, greatly reducing "down time" for inspection and maintenance. Metering problems and pressure fluctuations are reduced to a minimum because of rotary motion. Blades held out by centrifugal force, compensate for wear, maintaining original capacity for the life of the machine.

Shown here is another Fuller rotary installed in Texas. It's a C-200-200H, two-stage compressor driven by a gas engine through a gear reducer for boosting casing head gas from 5-lb. to 115-lb.

Write for Fuller Compressor literature.

FULLER COMPANY
132 Bridge St., Catasauqua, Pa.
SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION
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C-318
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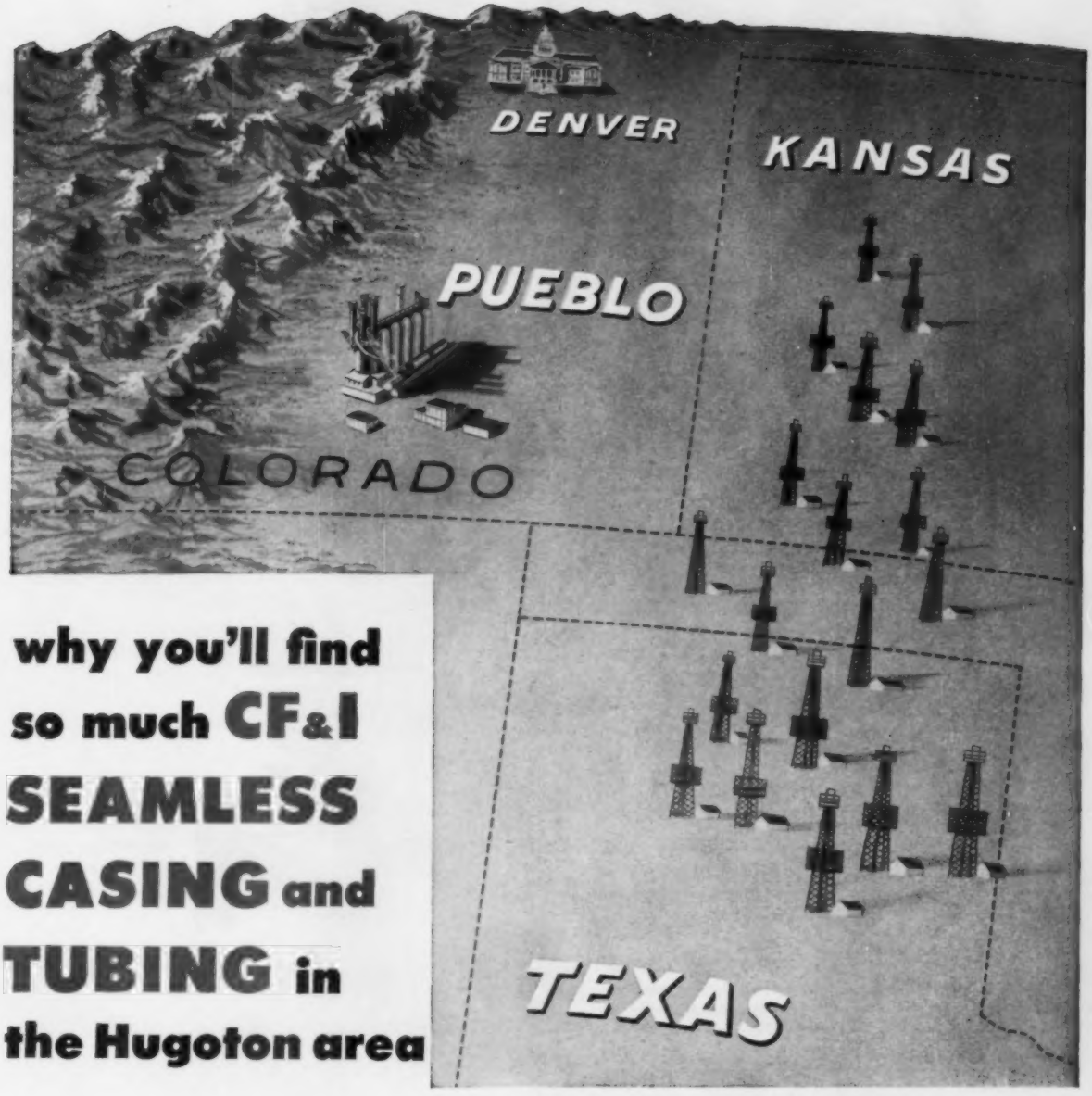
PIONEERS OF HIGH-EFFICIENCY VANE TYPE ROTARY COMPRESSORS SINCE 1930



why you'll find so much CF&I SEAMLESS CASING and TUBING in the Hugoton area

Encompassing parts of four states, the Hugoton Embayment is one of the biggest gas and oil producing areas. Throughout this vast area, which is in close proximity to our Pueblo Mill, drillers and operators know the quality of CF&I Seamless Casing and Tubing. As a result, you'll see load after load of CF&I seamless oil country tubular goods that have proved their ability to give dependable, trouble-free service.

Meeting or exceeding API STD 5A specification, CF&I Seamless Oil Country Casing and Tubing is available in 2⅜" through 9⅝" O.D.

CF&I SEAMLESS casing and tubing API

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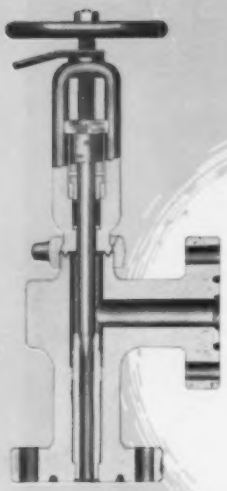
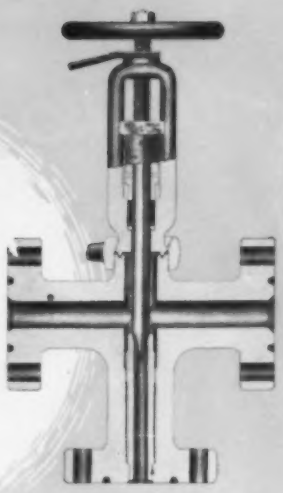
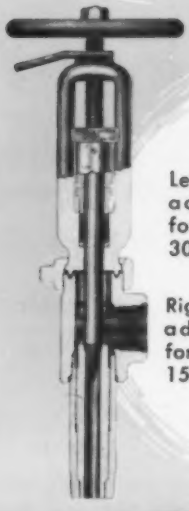
O·C·T offers a complete

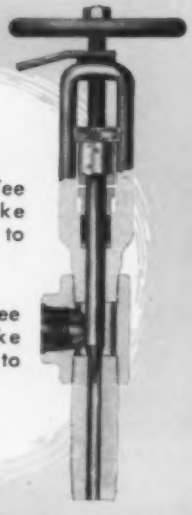




Type "N-2" Tee (Left) and Type "N-2" Cross (Right) adjustable chokes are suitable for pressures in excess of 3000 psi.

ADJUSTABLE CHOKES



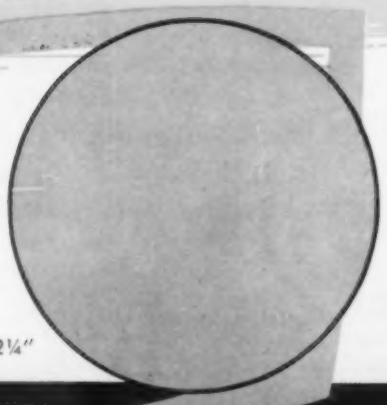


Left: Type "N" Tee adjustable choke for pressures up to 3000 psi.

Right: Type "O" Tee adjustable choke for pressures up to 1500 psi.

Type "JW" Tee adjustable choke for pressures up to 10,000 psi.

ALL SIZES



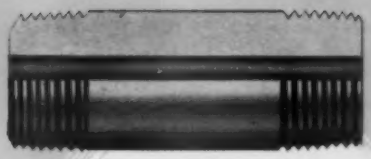
0.0273"

to 2¼"

ALL PRESSURE RATINGS

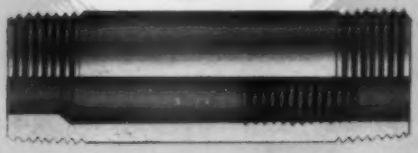
1,500 psi to 30,000 psi

line of chokes...and every one is the best of its kind!



OCT Type "FC-25"
Positive flow beam.

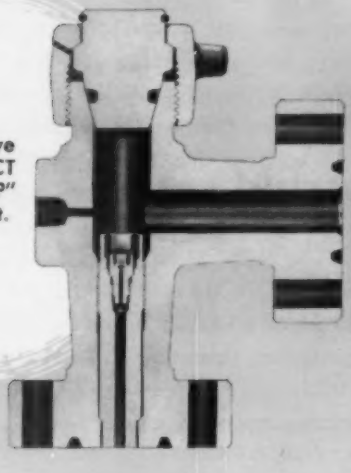
OCT Type "FC-140"
Cage nipple and
flow bean.



POSITIVE CHOKES

OCT makes a complete line of cross and tee choke fittings in all popular sizes and all pressure ratings, as well as a complete line of cage nipples, flow beans, and proration inserts. Most choke fittings will accommodate either positive flow beans or adjustable choke assemblies. This interchangeability reduces the inventory of parts required to service wells in a given field.

Type PC Positive
choke with OCT
Type "FC-142-P"
Proration insert.



OCT Type
"FC-142-P"
Proration
insert.

ALL parts of OCT Chokes are carefully made of materials best suited to the requirements of the well. Precision machining assures maximum safety as well as interchangeability of parts.

ALL MATERIALS

OCT Chokes are made in a complete range of materials from special analysis steel for general duty to tungsten carbide, monel or stainless steel for "problem" applications.

O·C·T

OIL CENTER TOOL CO.

A Subsidiary of Food Machinery and Chemical Corporation

Export Representatives: South America—East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

GUIBERSON'S TYPE H4 *Hydraulic Anchor*

TYPE H4 ANCHOR

with MORE FLUID BYPASS

The channeled body H4 Anchor gives you four operational improvements — faster going in, better circulation in the hole, faster pulling out and simpler clean-up.

Completely automatic in operation, the H4 incorporates a body designed for unusually large bypass area and tremendous holding power. It has a husky fishing connection on top. Case hardened piston slips are retained by a stainless snap ring that holds the slips in retracted position while going in or pulling — keeps the slips from dragging on the casing wall.

We recommend the H4 for holding down production-type packers in acidizing, fracturing or other below packer pressuring operations. The H4 not only improves circulation, but speeds up operations and cuts down maintenance costs.

Guiberson H4 Anchors are individually tested and available in a full range of casing sizes.

SAFE THAN SORRY
VIBERSON
BETTER BE

THE
GUIBERSON
CORPORATION

ESTABLISHED 1919
DALLAS, TEXAS
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Sold by
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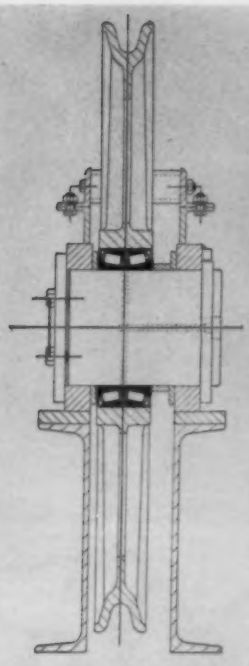
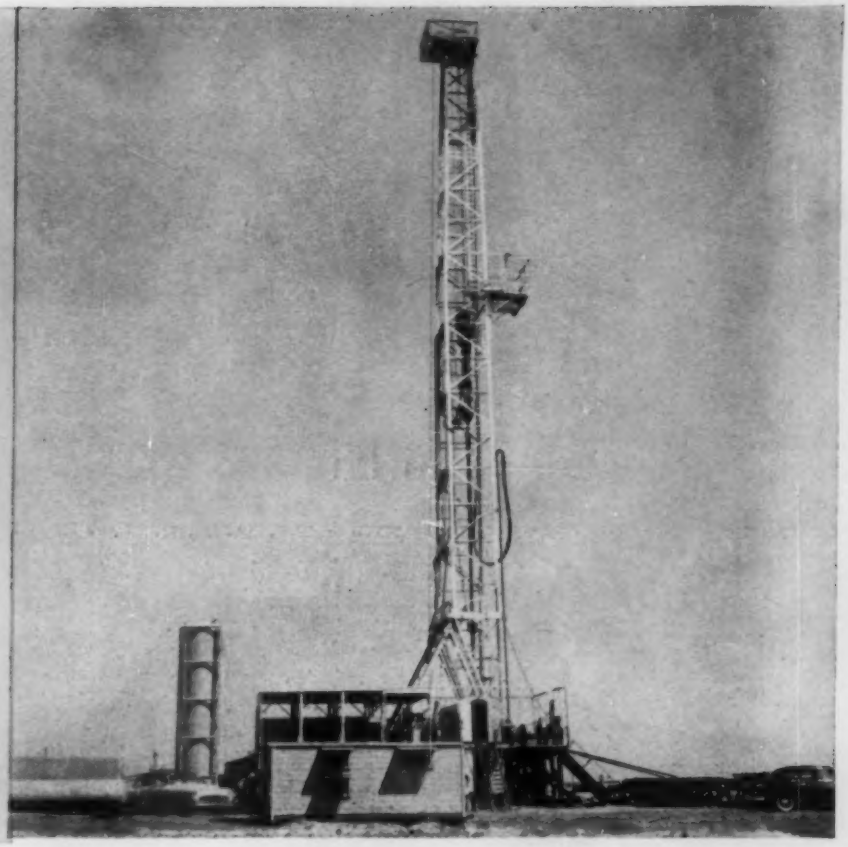
Everywhere



LEE C. MOORE CORPORATION mounts the fastline sheaves and other crown block sheaves on Timken tapered roller bearings for long bearing life with minimum maintenance.



New mast crown block makes improved position of "derrick man" possible, reduces fleet angle . . . all sheaves on TIMKEN® bearings

LEE C. MOORE cantilever masts offer a new crown block arrangement which permits the drilling line to enter the block approximately at the well centerline. With the fastline sheave set at an angle, and the flat side of the traveling block to the open side of the mast, improved working position is obtained for the operator on the racking platform, and the fleet angle problem is reduced.

All sheaves are mounted on Timken® tapered roller bearings, for easier rolling. Timken bearings take radial, thrust loads in any combination. It's the tapered construction. All rollers and races are case-carburized—to provide hard, wear-resistant surfaces over tough, shock-resistant cores. And full line contact between rollers and races gives Timken bearings *extra* load-carrying capacity.

Geometrically designed and precision-made to give true rolling motion, Timken bearings meet rigid quality controls from melt shop to finished bearing. We use alloy steel so fine we have to make it ourselves. No other American bearing maker does this. So, when you build or buy equipment for drilling, look for the trade-mark "Timken" The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN TAPERED ROLLER BEARINGS ROLL THE LOAD

TRADE-MARK REG. U. S. PAT. OFF.

makes precision lapping
a simple, low-cost tool
for all industry!

BYRON JACKSON'S *all-new*

LAP-KING

Here, for the first time, is a precision lapping machine that is fool proof. Any mechanic can operate this bench-type machine and produce lapping accuracy to 11.6 millionths of an inch. Quality control is easily maintained because the BJ Lap-King is specially designed to relap its own plates, one against the other, after a normal job run. This assures consistent optically-flat lapping plates for automatic accuracy of lapped work. The hour meter records the exact amount of lapping time on each plate. An automatic timer provides job time control.

Lap-King is ideal for mechanical seal refacing for refineries, pipelines, power plants, etc. and for any repair work and small production runs in industry where lapping precision is desired.

SPECIFICATIONS

Width	15"
Depth	14½"
Height of case	12"
Height to top of Star Nuts	16⅜"
Motor	¼ HP 110 volt
Dia. of lapping plates	9"
Net weight	165 lbs.
Shipping weight	220 lbs.

Contact your nearest Byron Jackson sales engineer or write to:

BJ

BYRON JACKSON PUMPS
INCORPORATED
A subsidiary of Borg-Warner Corporation
P. O. Box 2017A, Terminal Annex
Los Angeles 54, California

NEW WAY

to better buys

This tool pusher is considering and selecting operating parts and maintenance items. He's doing it at the place that's been specifically designed for careful, simple

Continued on next page

Continued from previous page

and efficient buying—today's National Supply Store.

Like other National customers, he gains several advantages by shopping in a National Store—and you can gain them, too.

The planned arrangement of counters, bins and warehouse areas makes it easy for you to personally select and compare before buying. The National Store personnel are ready to give you complete up-to-date information and prices on the items you're considering. They'll fill you in on field performance that other operators have reported.

Most important of all, here's where you can see and learn about new, proven items—products that may improve your present operations.

Today's National Supply Store carries stocks that have been carefully selected and tailored to the needs of your area. Items not normally stocked are quick-ordered and rushed to you—the result of one of the most modern communications systems in the oil country.

You'll find that the modern facilities and services available in National Supply Stores will help you operate more efficiently. Why not take advantage of the NEW WAY to better buys—stop in at the local National Supply Store tomorrow.

It's built to last the

National "Type E" Pumping Units are as rugged and dependable as modern engineering and manufacturing can make them! Every feature and part has been designed to give you maximum service with a minimum of maintenance. Here are a few examples:

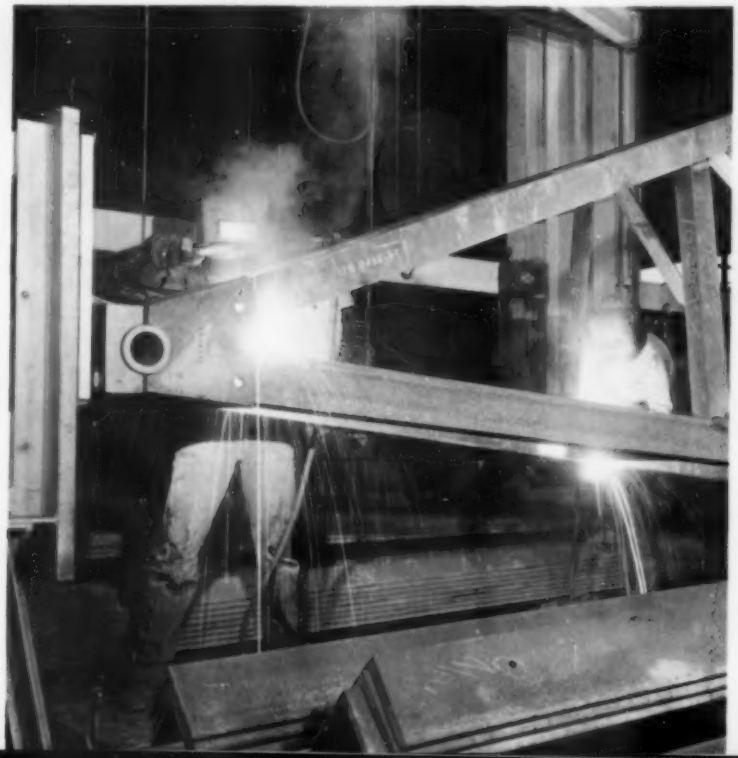
- Extra strong main base with maximum rigidity and counterweight clearance for quick, easy floor level installation.
- Tough, hard alloy steel gears and pinions—gear train mounting and main bearings permit lower shaft loading and deflection—easily handles shock loads from load reversals.
- Stable, well-balanced samson post—rigidly cross-braced, built to distribute beam load evenly over entire foundation area.
- Simple Pitman components assure positive alignment and correct fitting—are easily field-serviced.
- Extra heavy duty walking beam and beam hanger for years of rugged service.

National's complete line of pumping units includes 22 standard API sizes plus various long stroke and portable variations.

Sizes range from the D-3SN-6DP having a 3200 lb. API Beam rating and 6400 in.-lb. API Gear Reducer rating to the D-32SB-456 DW with 32,400 lb. API Beam rating and 456,000 in.-lb. API Gear Reducer rating.

Get all the facts on National's complete line of Pumping Units today. New bulletins describing these quality units are available at the National Supply Store or from National representatives in your area.

These welders use a special, extremely accurate jig for samson post assembly. This is typical of the quality manufacturing operations performed at one of the newest and most modern oil field equipment plants in the U.S.–National's Gainesville, Texas, plant.



life of the well!

THE **NATIONAL SUPPLY** COMPANY

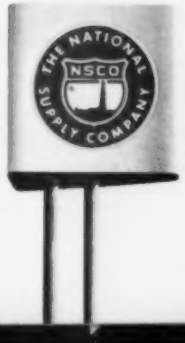
MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Pa.

DIVISION OFFICES: Dallas; Denver; Houston; Toledo; Tulsa; Torrance

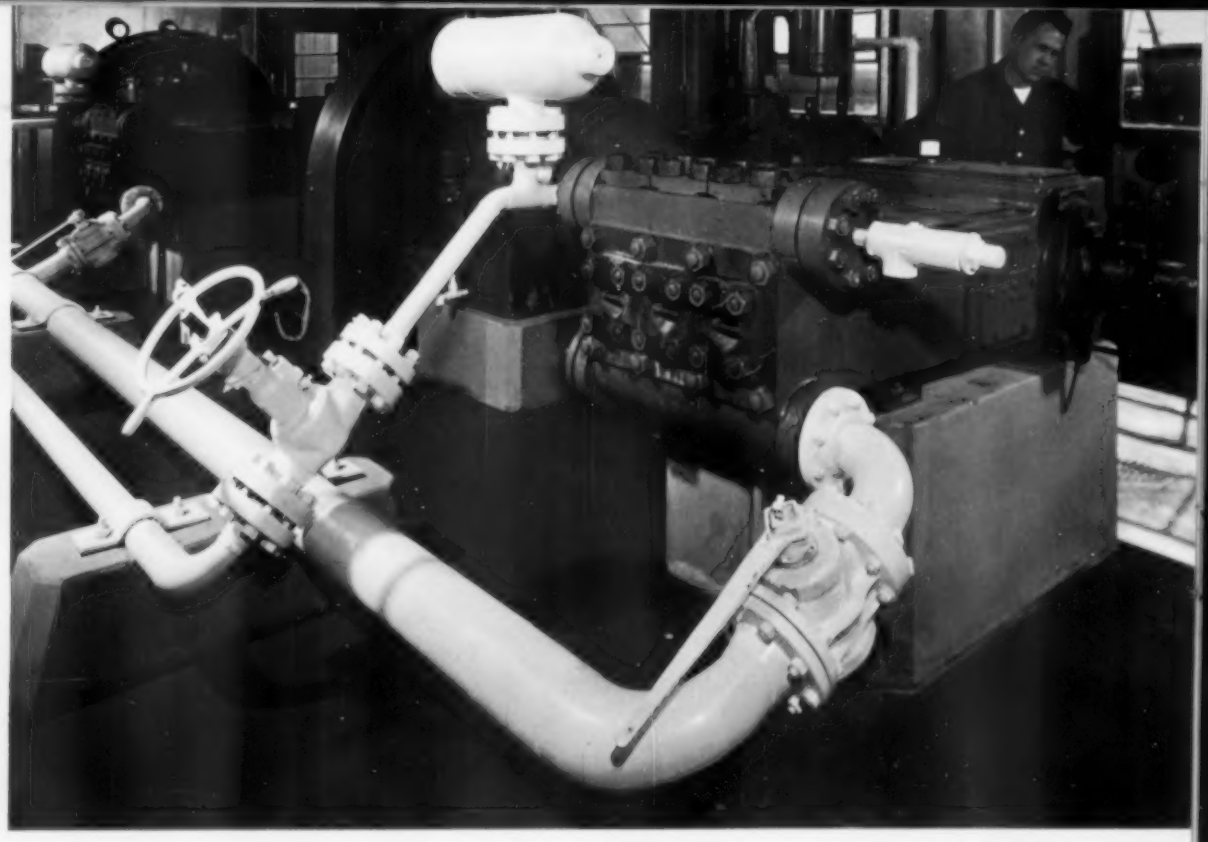
CANADA: The National Supply Company, Ltd., 200 F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta

EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E. C. 1

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT



More National equipment for profitable production ...on the next page



For your special pumping jobs:

Rugged National Triplex Pumps!

Waterflooding is just one of the many jobs you can do profitably with National Triplex Pumps. They perform well on salt water disposal, high pressure testing, formation fracturing and acidizing, and as power-oil pumps for sub-surface hydraulic systems. Wherever you put them to work, they deliver dependably—with little service downtime.

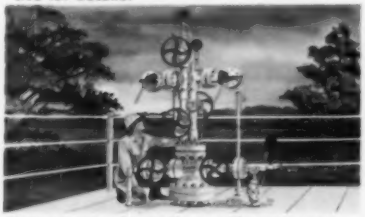
National Triplex Pumps have heavy-duty frames and housings, long-life bearings, stainless steel valves, and National's time proven lubrication systems.

Plungers, fluid ends and stuffing boxes are interchangeable to meet varying pressure and volume needs and are available for either corrosive or non-corrosive service.

Check into all of the profitable features of National Triplex Pumps —the nearby National Supply Store or representative has complete information and bulletins for you.

Get reliable service from precision-made National Sucker Rods. They have top resistance to fatigue, shock, corrosion, and impulse loads. Available in a range of grades for every condition.

National Plunger Lift can be the best production method for certain types of wells. It uses formation gas or injected gas for operation. Ask your National Representative for details.



Interchangeable units provide many combinations to meet your specific needs in size, capacity, and type. Ease of assembly and pre-tested safety are two features of National Wellhead Equipment.

THE **NATIONAL SUPPLY** COMPANY

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NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

By Merle Davis—Ralph Foster
Johnston Testers

FOR MORE INFORMATION ON YOUR DRILL STEM TEST

A check-off list for reverse circulating drill stem tests

The practice of reversing out the recovery of a drill stem test made in either an open or cased hole is now being widely used. The success of the practice has been proven with both high and low pressure tests and with both high and low liquid recoveries.

REVERSE CIRCULATION IN PERMIAN BASIN (OPEN HOLE TESTS)

The type A "sleeve" and the type B "knock-off" valves are preferred by the majority of the oil companies in West Texas. The type "B" sub has a slight edge because it can be run down in the drill collars closer to the test tool assembly.

The location of the reversing valves is dependent on the amount of "sample" to be left in the pipe and whether or not drill collars are run on top of the test tool assembly. The type "A" sub must be run above any small I. D. drill collars while the type "B" can be run "down" in the drill collars. It is common practice to separate the hydraulic valve and the shut-in valve (in the basic test tool assembly) by one or two singles—this provides a clean sample of the last fluid the formation produced into the drill pipe. The "sample" recovered above the shut-in tool and below the reversing sub may be slightly contaminated by the mud.

The high viscosity of the mud and the use of lost circulation material in some wells make it advisable to run both types of reversing subs each providing two reversing ports.

The reversing subs are opened *after* the mud pumps are started and mud is being pumped into the annulus. Normally, the difference in hydrostatic pressure (mud outside the drill pipe and oil, gas or water inside the pipe) will reverse almost all the fluid produced by the formation. In order to complete the reversing operation, the rams can be closed and *moderate* pressure applied to the hole. Extreme care must be used in pumping into the open hole to prevent breaking down a formation and causing lost circulation.

After reversing, the pipe can be pulled dry because the mud (which replaced the formation fluid) will drain back through the reversing sub ports.

Reverse circulation check off list

Before operating reversing valve

- ☐ Pump running
- ☐ Mud line valves positioned to divert mud flow to annulus
- ☐ Rams and/or Hydril checked for operation

Operating Reversing Valve (Type A and/or Type B)

- ☐ Close well in at surface
- ☐ Disconnect high pressure steel flow hose
- ☐ Close shut-in tool by rotating
- ☐ Reconnect high pressure steel flow hose
- ☐ Bleed down drill pipe (if go-devil hanger not used)
- ☐ Check mud in annulus (*must stay full* throughout reversing operation). Packer may be pulled loose if shut-in period is completed
- ☐ Drop proper go-devil to operate reversing sub
- ☐ Close surface valve (keep closed as long as annulus is *not* full)
- ☐ Control flow of recovery with surface valves so that hole remains full of mud.

NOTE: If reversing stops, apply moderate pressure to annulus or apply moderate pressure to tubing or drill pipe until normal circulation is barely established then go back to reverse circulation.

When natural reversing is completed or to speed reversing procedure

- ☐ Close rams or Hydril
- ☐ Apply moderate pump pressure to annulus
- ☐ Stop pumps when clean mud of normal weight is reversed
- ☐ Remove flow head and come out of hole at proper speed (prevent swabbing). Pipe should pull dry.

A supplemental article on Reverse Circulation in the Gulf Coast area is now being prepared. Look for it in this publication. For complete information on Reverse Circulation write Johnston Testers, Houston, Texas.

Merle Davis
Dist. Mgr.
Crane, Texas

Ralph Foster
Dist. Mgr.
Snyder, Texas

Type B Reverse Circulating Sub

Type A Reverse Circulating Sub

JOHNSTON TESTERS

A Subsidiary of Schlumberger Well Surveying Corporation

first in drill stem testing

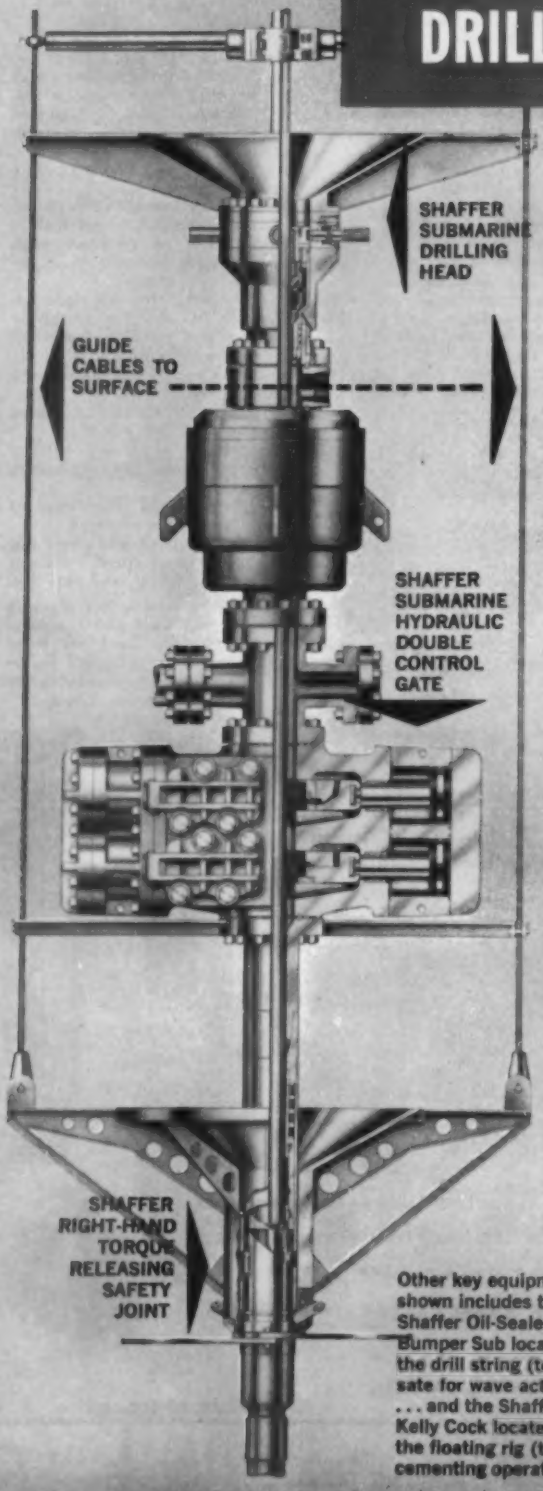
HOUSTON, TEXAS

LONG BEACH, CALIFORNIA • CALGARY, CANADA

FORMATION AND CASING TESTING — JOHNSTON

Here's the Submarine Drilling Equipment That Is Revolutionizing the Industry!

THE SHAFFER SUB-SEA DRILLING HOOK-UP


SHAFFER SUBMARINE DRILLING HEAD
GUIDE CABLES TO SURFACE
SHAFFER SUBMARINE HYDRAULIC DOUBLE CONTROL GATE
SHAFFER RIGHT-HAND TORQUE RELEASING SAFETY JOINT

Other key equipment not shown includes the Shaffer Oil-Sealed Drilling Bumper Sub located in the drill string (to compensate for wave action) . . . and the Shaffer Type 55 Kelly Cock located on the floating rig (to simplify cementing operations).

Throughout the oil industry—wherever oil men are interested in drilling beneath the surface of lakes, bays, open ocean or similar locations—you'll find the new Shaffer Sub-Sea Drilling Procedure is making possible an entirely new approach to submarine development programs.

- Now exploratory work can be done from relatively inexpensive barges and converted landing ships instead of the costly drilling islands and special platforms heretofore required!
- Now the foundation problems of supporting drilling platforms on ocean beds and coastal shelves are eliminated because the drilling operations are conducted from a floating vessel!
- Now the storm and rough water hazards to equipment are minimized because drilling and landing equipment is on the ocean floor protected from exposure to the buffeting of surface waves!

Key to this new technique is the Shaffer Hook-up shown at left. Based upon Shaffer advanced pressure control units already field-proven in land-based operations throughout the oil world, this simplified hook-up permits the operator to drill and complete exploratory operations from the floating ship or barge . . . and to maintain pressure control from spud-in through plug-off. It sets entirely new standards of economy, speed and efficiency!

A 12 page brochure is available describing the equipment and procedures. Write for your free copy, or see your nearest Shaffer representative!

Shaffer equipment is described in the latest edition of your Composite Catalog.

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

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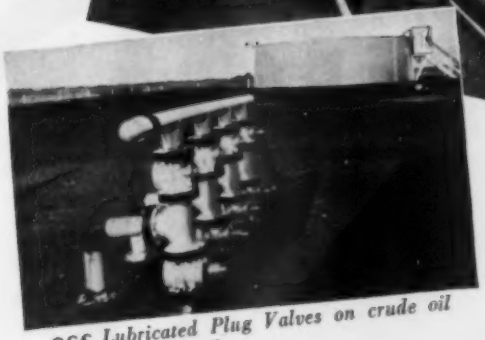
OKLAHOMA CITY, OKLAHOMA, Shaffer Tool Works, 6201 South Shields Boulevard
FARMINGTON, NEW MEXICO, Shaffer Tool Works, Post Office Box 546
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 1788
EXPORT SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N. Y., U. S. A.

34 years OF OIL TOOL LEADERSHIP

14 reasons why you get superior performance from acf LUBRICATED PLUG VALVES

acf Valves on suction and discharge lines—natural gas compressor station.



acf Lubricated Plug Valves on crude oil storage tank header.

1. Wide Port—Maximum Flow Efficiency
2. Full Pipe Area
3. Patented Head Gasket made of tough self-lubricating Teflon*
4. Perfectly lubricated (gun or stick)
5. Tight against head leaks under any line pressure
6. Minimum number of parts
7. Lubricant protects against wear and corrosion
8. No exposed seating surfaces
9. Quick opening
10. Installed in any position
11. Compact: fits into small space; gate valve face-to-face dimensions where needed
12. Non-wedging cylindrical plug provides easy operation
13. Easily dismantled for repairs
14. Lubricant release to prevent contamination

*DuPont's tetrafluoroethylene resin.

S704

Study this list of design and operating advantages and you will see why acf Lubricated Plug Valves are meeting the requirements of thousands of plants throughout the nation.

acf Valves permit your piping system to handle fluids with maximum efficiency at minimum cost in time, labor and power. Protected seating and sealing surfaces, leak-proof head seal, non-wedging plug reduce "down time" and maintenance to a minimum.

For higher efficiency—longer life—lower cost —specify acf Lubricated Plug Valves.

acf Valves are available in semi-steel, carbon steel, bronze and aluminum.

Sizes: ½" to 24".

Pressures: semi-steel; 175 lbs. WOG to 500 lbs. WOG.

Carbon steel: ASA 150 and ASA 300.

Representatives in all principal cities.

Ask your Industrial or Mill Supply Distributor for acf Valves.

W-K-M
DIVISION OF ACF INDUSTRIES INCORPORATED

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Write Dept. A-923 for new ACF Valve Catalog 400.

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BLUE

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over high lifting costs on small volume sandy wells—

oilmaster

SAND HOG PUMPS

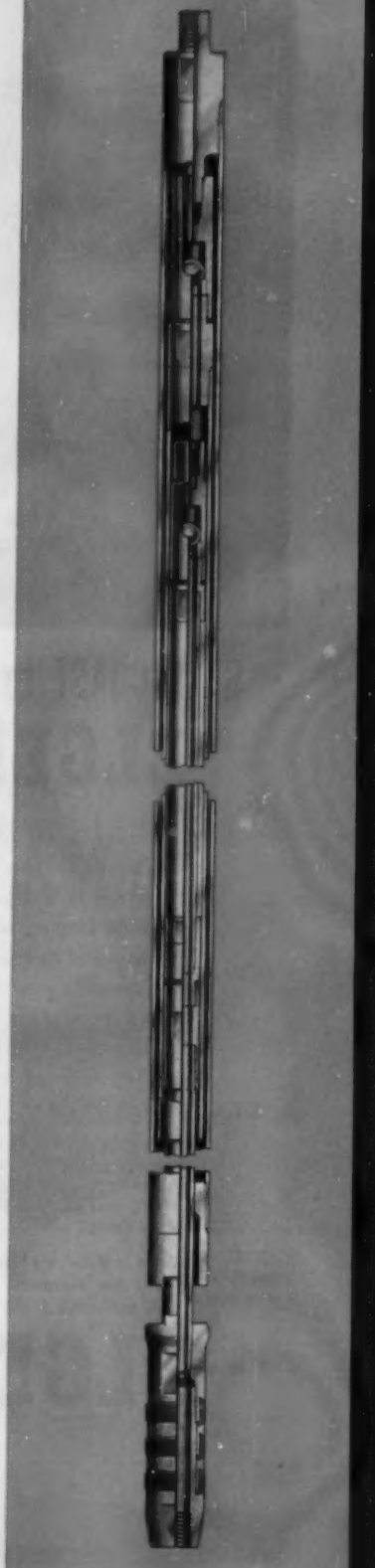
were designed with the elimination of high lifting costs as an objective—the results—a small bore pump so trouble free in its operation that it has actually prolonged the economic life of stripper wells.

The Sand Hog is purposely built with small fluid passages so the velocity of the discharged fluid remains high, preventing any settling of entrained sand. A skirt diverts the discharge of the fluid to a point below the bottom of the traveling barrel—continuously washing the hold-down and flushing the annulus between the pump and the tubing free of sand. The cleanest oil that will separate out of this produced fluid floats up between the pull tube and barrel, and on each suction stroke supplies a film of oil to lubricate and reduce friction between the barrel and plunger.

If you are blue over high lifting costs on low volume wells, ask your Oilmaster Representative to deliver a Sand Hog before your next pulling job and prepare for a change of mood when you compare its trouble-free performance with that of any pump you have previously run.

oilmaster PUMPS FOREMOST IN THE INDUSTRY

FLUID PACKED PUMP CO.



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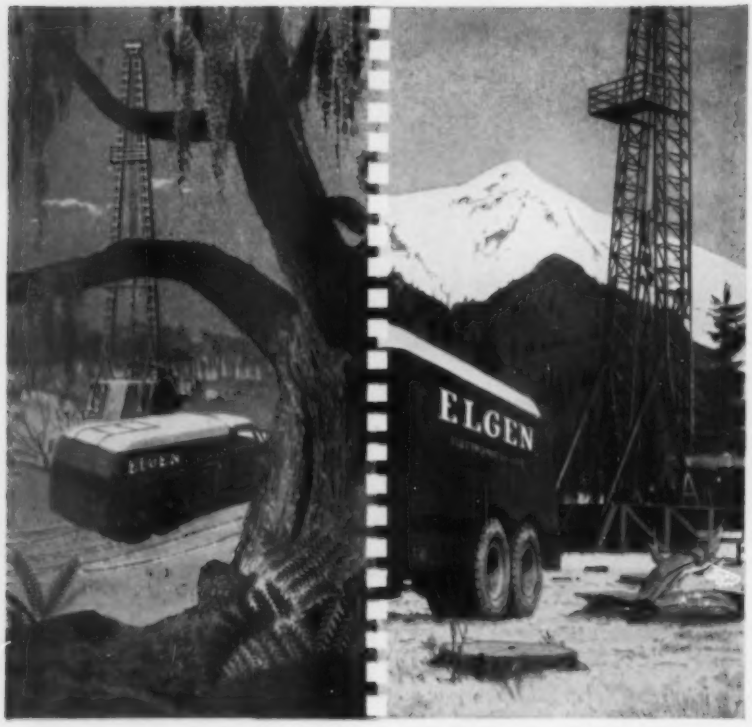

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ELGEN takes them all!

There's a world of difference in formation and terrain characteristics between these two scenes. And a world of difference in equipment and technique needed to give you accurate logging and log analysis. Elgen knows this, and has designed its specialized equipment, and trained Elgeneers and crews to meet the particular needs of specific oil areas. When the familiar Elgen green truck stops to service your well, you know the most accurate services are yours.

ELGEN services:

electronic logging	perforating	collar locator
permalogging	differential temperature logging	depth determination
hole caliper	geophone service	depth scales, 1", 2", 5", 10", 25"
sidewall coring	conductivity logging	
nuclear logging	limestone curve	quantitative reports

Elgen offices are located in major oil areas... call or write today for complete information on Elgen well logging, coring and perforating advantages.

THE ELGEN CORPORATION

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FLeetwood 7-3958

They Say—

Water flooding proved again

Dear Sir:

In your article "Spraberry Finally Pays Off for Some" in the September 2, 1957, issue of The Oil and Gas Journal, page 92, are the following statements:

"And then there is Spraberry's new big hope. This is the plain old every-day garden variety of water-flooding—the thing that was not supposed to be any good for Spraberry," and "The main thing is that the pilot has proved that a conventional five-spot will work and that it can be profitable."

I am enclosing a reprint from the February 25, 1952, issue of The Oil and Gas Journal concerning the Kirk field (in Eastland and Comanche counties, Texas) . . . I am also enclosing a reprint of Paper No. 751-G of A.I.M.E. which appeared in a condensed version on page 122 of The Oil and Gas Journal, June 17, 1957.

If you will read these two papers I think you will agree that you have missed three important points relative to the Spraberry, as follows:

1. The oil in the Spraberry is in the matrix and not the fractures. You proved this from Atlantic's data in your article "Imbibition Successful," The Oil and Gas Journal, March 29, 1954.

2. Both the Atlantic experiment and the Humble pilot-flood had injection wells located such that flooding was (and is) forcing some of the injected water through the formation at approximately right angles to the apparent directional trend of the fractures.

3. That (from Conclusion No. 7 of A.I.M.E. Paper No. 751-G) "For economical production rates at 'economic' water percentages oil 'fronts' must arrive at the producing well bore under pressure, and this can be best accomplished in a fractured formation by flooding across the fracture system (if the trend is determinable and consistent) in a pattern as nearly conventional as possible."

For 5 years I have been telling everyone who would listen that Kirk field and the Spraberry were similar in several ways and that, due to the fracture system trend, successful water-flooding operations could be conducted in the Spraberry if injection wells were located along the apparent fracture system trends so that eventually injected water would be forced across the frac-

The Most Economical Pumping Unit Ever Built

. . . and the smoothest operating

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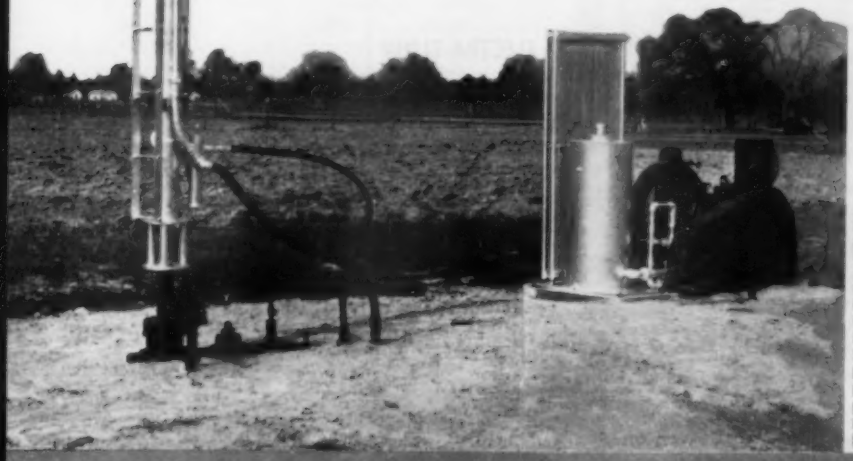
Hydraulic
PUMPING UNITS

The low price of Johnston Hydraulic Pumping Units is due to streamlined, simplified design and manufacture, made possible by years of experience in production and hydraulics.

From grass roots to 9000 feet—that's the range of Johnston Hydraulic Pumping Units. They may be powered by electric motor or any type internal combustion engine.

Remember this. Here is a pumping unit that will SAVE YOU MONEY—Cost you Less than any competitive unit. Less for Transportation; Less for Installation; Less for Maintenance; Increase Life of Sucker Rods, Bottom Hole Pump, and in many instances increase production.

3 FT. STROKE **6 FT. STROKE** **9 FT. STROKE** **12 FT. STROKE**



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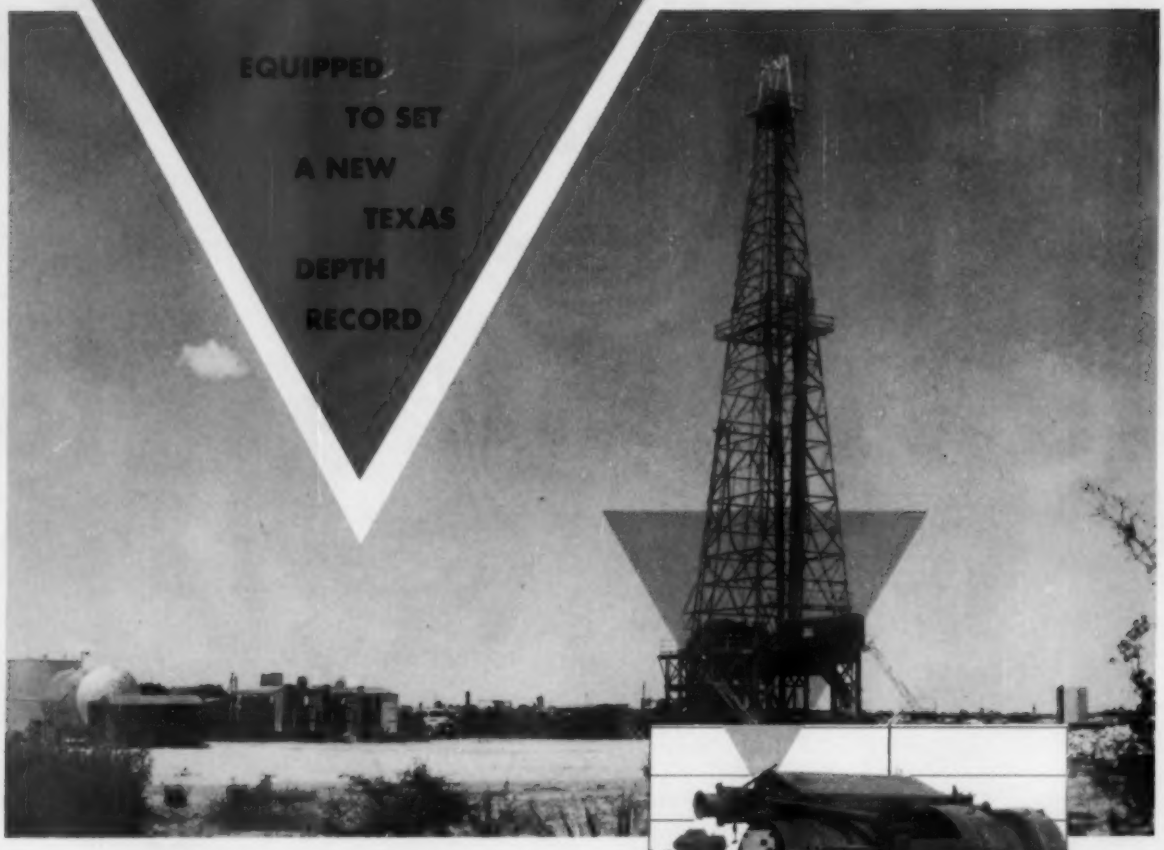
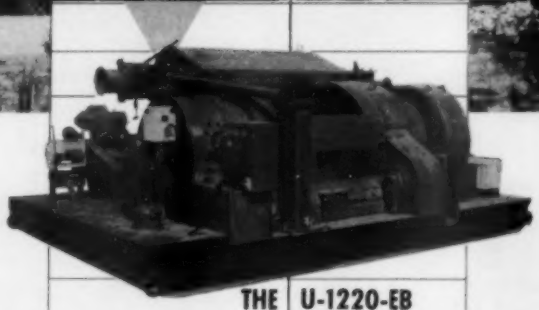


The rig now drilling toward a new Texas depth record of 22,000 ft. in Pecos County is equipped with a U-1220 electric draw works.

The choice of equipment for this deep test was of primary importance. In selecting the U-1220 draw works, the contractor has assured the operators speed of operation, minimum down time, and dependable performance.

Simplicity of operation and ease of maintenance are design characteristics of the unit. The U-1220-EB Electra-Flow Draw Works is available in a single or split package. Included among other important features are extra large diameter and wide spooling drum, large braking capacity, and centralized lubrication.

You can depend upon a Unit Rig draw works to turn in an outstanding performance—anywhere—because it is "designed for the job."



THE U-1220-EB
ELECTRA-FLOW
DRAW WORKS

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ture system through the matrix to the producing well . . .

With wells present, economical water-flooding operations can be conducted in marginal reservoirs that may not have produced economically under primary production operations, yet there will always be engineers and production men who will say you cannot put water into some zone from which oil and gas have been produced.

They have said it about the Haynesville, La., Pettet lime; the Kirk field Marble Falls lime; and about the Spraberry. Sometimes I doubt that anyone in the oil business reads your excellent magazine.

P. S. Ervin
Petroleum Engineer
Abilene, Tex.

Journal booklet "informative"

Dear Sir:

Some little time ago I received a booklet entitled "Oil Hits Back." I believe it came from one of the oil companies in which I hold some stock.

I think that it is one of the most informative pieces of literature to combat the foolish and dangerous actions of some of Washington's law makers that I have ever seen. Such pieces of literature deserve wide distribution.

Arlington C. Bauer
Rensselaer, New York.

Hands off the pipelines

"Any change in the ownership of oil pipelines would prove extremely detrimental to the best interest of the thousands of now satisfied independent producers in marketing their crude oil and to numerous independent refiners who now enjoy efficient and economical transportation in receiving their raw material requirements by pipeline.

"Therefore, no recommendation should be made for further regulation of the pipeline industry."

Sen. Everett M. Dirksen, (R-Ill.), commenting on the Justice Department investigation of the pipeline industry suggested by Sen. Joseph O'Mahoney, (D-Wyo.).

Secret of technical progress

"Invention by itself is abstract and static. Tremendous financing is required for technological development to make the invention workable and available for the benefit of mankind. Uniting of the efforts of the inventor and of the businessman is the key to the success of western civilization and to our rapid technological development. Furthermore, our technological development has been most rapid in those

The Coffing
Mighty Midget Puller

Compact and lightweight, the Coffing Mighty Midget Pullers are handy lifting tools for all types of industries. The 1000 lb. capacity model weighs but 9¼ lbs. and requires only 40 lbs. of handle pull. The 500 lb. model weighs 6½ lbs. and requires only a 28 lb. pull for full rated capacity.

The handle can be operated as a crank for fast lifting, or it can be used as a lever for short pulls, or for working in cramped quarters. Should the puller be overloaded, the "safety valve" handle will give before any load bearing part fails.

For full information on this compact, light and inexpensive lifting tool, consult your favorite supply store, or write for Bulletin MP.

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Ratchet Jacks, Screw Jacks, Hydraulic Jacks, Special Worm Gear Jacks, Ratchet Hoists, Electric Hoists, Load Binders, Spur Gear Hoists

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McCullough® REPORTS TO THE OIL INDUSTRY

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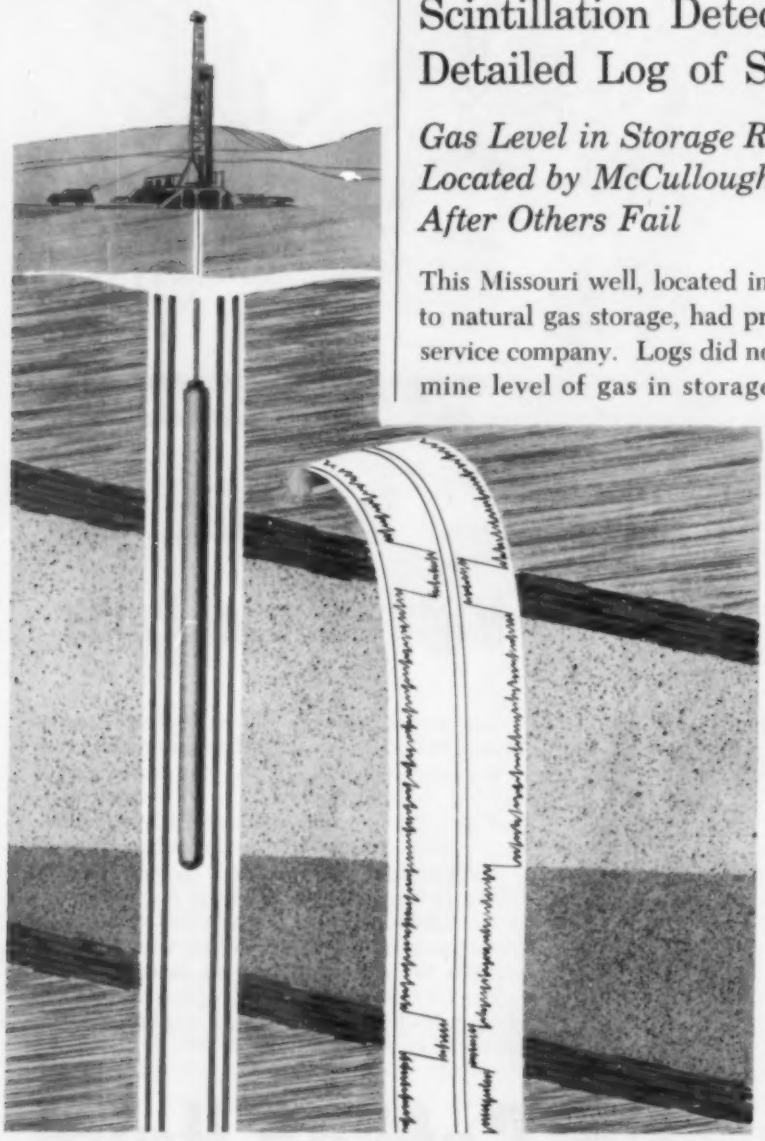
New Services • • • New Tools • • • New Methods • • • Outstanding Results

Scintillation Detector Provides Detailed Log of Storage Reservoir

Gas Level in Storage Reservoir Accurately Located by McCullough Radiation Well Logger After Others Fail

This Missouri well, located in a field that had been converted to natural gas storage, had previously been logged by another service company. Logs did not show enough detail to determine level of gas in storage reservoir.



Scintillation Detectors, used in McCullough down-hole logging instruments, have an efficiency approaching 100% in detecting and measuring nuclear radiations.

McCullough ran both 5″ = 100′ and 2″ = 100′ scale combination Gamma Ray-Neutron Logs. The clear, accurate detail of the curves showed the exact level of gas in storage. Operator was very pleased with the successful outcome of the job.

The success of this logging operation was not an isolated instance. Later, another well in the same field, previously logged by two other service companies without results, was relogged with McCullough's Radiation Well Logger—again obtaining reliable, accurate Gamma Ray and Neutron Curves.

The job shown above is certified to be a true field report of service rendered.

McCullough® TOOL COMPANY

Cable Address: MACTOOL

LOS ANGELES
HOUSTON
EDMONTON

parts of our western civilization where maximum individual freedom enabled the inventor and businessman to get together with the greatest ease.

"Why is technological development in Russia so rapid but individual freedom at such a low level? . . . If Russia could not copy technological achievements from the West she would wallow in technological stagnation.

"In the petroleum industry we have enjoyed teamwork among the scientist, the engineer, the skilled technician, and the entrepreneur. This has reaped substantial consumer benefits despite the denials of some politicians."

Chalmer G. Kirkbride, executive director of research, patent and engineering departments, Sun Oil Co., on "Meet the Engineer" over station WFLN-FM, Philadelphia.

Integrated company competes

"What is the spur behind development of integrated business organizations? The answer boils down to these reasons: Increased efficiency, reduced costs, and new and better products at the lowest possible price . . .

"Then what is the complaint of those who attack integrated companies? They say that integration tends to eliminate competition. When they make this charge they are confusing 'integration' with 'monopoly' . . . These two words have no common meaning . . .

"The integrated oil company takes its chances in the market place of each phase of the industry against companies of single-phase operations and against other integrated companies. The competition among the large integrated companies is probably most vigorous of all."

Article in the September issue of Shell News, Shell Oil Co. magazine.

Risk faces Algerian investors

"Events of the past year in the Arab world as a whole, particularly in Egypt and Syria, should serve as food for thought to anyone dealing or attempting to deal with any part of the Arab world of which Algeria today is a focus of undivided attention.

"To begin with, one has to keep in mind that France has no love for U.S. oil interests . . . France aimed at perpetuating her exclusive control of Algeria and her natural resources through the fiction of maintaining Algeria on the books as part of metropolitan France. Now France is trying to maintain her present position in Algeria through inviting foreign interests to invest in exploration of the natural wealth of that country . . .

"The inevitable conclusion for the Arabs in case U. S. interests start flooding the Sahara would be to regard the business interests of U. S. oil companies as part of France's political plot to maintain Algeria as a colony. And that would be tantamount to widening an already wide gap in the assessment of Arab-U. S. relations in this cold-war world in which we all live.

"An independent Algeria would more than welcome, as Morocco and Tunisia have amply demonstrated, U. S. capital investment including oil interests. But the French plot . . . will only antagonize the Arabs of Algeria and the rest of the Arab world further. You can't then blame the Arabs for further sabotaging the so-called jugular veins of the free world."

James A. Sa'd, research officer, Arab States Delegations Office, New York, in a letter to the Wall Street Journal.

CALENDAR

SEPTEMBER

25 Natural Gasoline Association of America, regional meeting, Northern Hotel, Billings, Mont.

26-27 Western Petroleum Refiners Association, Rocky Mountain regional tech-

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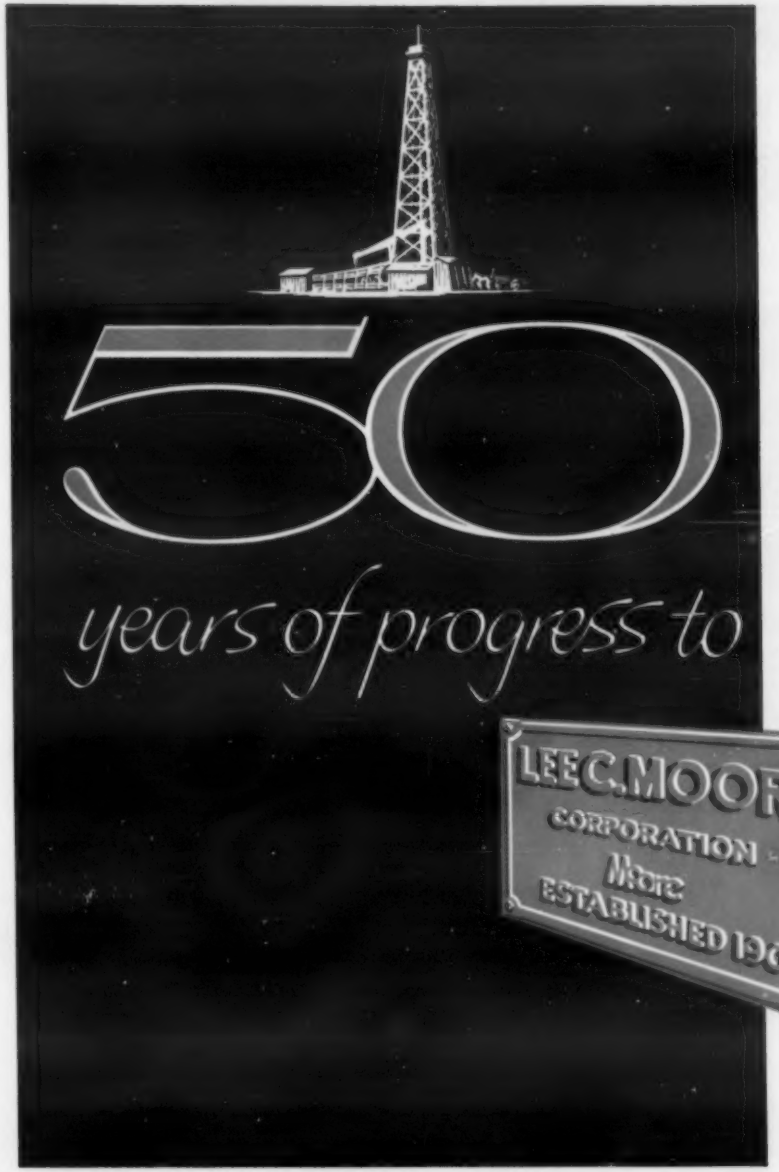

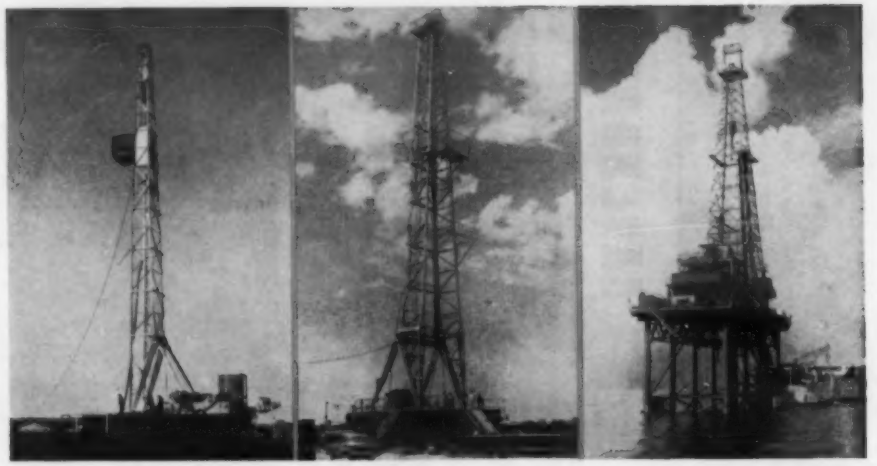

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nical-industrial relations meeting, Henning Hotel, Casper, Wyo.

26-27 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, Roosevelt Hotel, New Orleans.

28-
Oct. 2 American Oil Chemists' Society, 1957 fall meeting, Netherland Plaza Hotel, Cincinnati.

OCTOBER

1-2 Texas Mid-Continent Oil and Gas Association, thirty-eighth annual meeting, Texas Hotel, Fort Worth.

1-4 National Association of Corrosion Engineers, north-central region, Sherman Hotel, Chicago.

1-4 National Association of Corrosion Engineers, south-central region, municipal auditorium, Oklahoma City.

2-4 Golden Trend Oil Show, Pauls Valley, Okla.

6-9 Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, fall meeting, Adolphus, Baker, and Statler Hilton Hotels, Dallas.

7-9 National Electronics Conference, thirteenth annual meeting, Hotel Sherman, Chicago.

7-9 American Gas Association, annual convention, Kiel Auditorium, St. Louis.

7-11 American Institute of Electrical Engineers, fall general meeting, Morrison Hotel, Chicago.

10-11 California Natural Gasoline Association, thirty-second annual fall meeting, Huntington-Sheraton Hotel, Pasadena.

10-12 American Society of Mechanical Engineers, American Institute of Mining, Metallurgical & Petroleum Engineers, fuels conference, Chateau Frontenac, Quebec.

10-13 Louisiana Gulf Coast Oil Exposition, Lafayette, La.

13-15 American Association of Oilwell Drilling Contractors, seventeenth annual meeting, Mayo Hotel, Tulsa.

13-19 OIL PROGRESS WEEK.

15-16 Gas Measurement Institute, sponsored by the University of Kansas, American Legion Hall, Liberal, Kans.

16-17 South Dakota Independent Oil Men's Association, convention, Alonzo Ward Hotel, Aberdeen, S. D.

17-18 American Institute of Mining, Metallurgical, and Petroleum Engineers, Southern California petroleum section, fall meeting, Biltmore Hotel, Los Angeles.

17-18 Abilene, Tex., Geological Society; Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, Abilene chapter; West Central Texas Oil and Gas Association; and McMurry College, second annual petroleum conference on new developments and applications in log interpretation techniques, McMurry College, Abilene, Tex.

17-19 Four Corners Geological Society, second field conference, Gallup, N. M.

18 American Institute of Chemical Engineers, South Texas section, twelfth annual technical meeting, Moody Convention Center, Galveston, Tex.

20-22 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Peabody, Memphis.

23-25 National Association of Corrosion Engineers, western region, seventh annual conference, U S. Grant Hotel, San Diego, Calif.

23-25 National Association of Corrosion Engineers, seventh biennial Permian

COLD facts about a HOT subject . . .

Stewart Stoves

● Decide right now to replace make-shift heating facilities this winter with clean, safe, dependable Stewart Stoves.

Equipped with regular Stewart Hi-Efficiency B-4 gas burners—"The Burner without an equal"—Stewart Stoves provide plenty of heat at low cost, for derrick floors, warehouses, supply stores, garages, industrial plants, etc.

They are furnished for use with either natural, butane, propane or manufactured gas—furnished with or without vents.

Natural gas stoves furnished with gas valves, pilot light and pressure regulator. Butane stoves do not have pilot light and pressure regulator.

CONSTRUCTION: Bodies are heavy sheet steel. Rounded top, baffle plates and legs are cast iron. Finished with high temperature aluminum paint.

SIZE:

Model 15: 50,000 BTU, 35" high by 19" O.D.
Wt. 100 lbs.

When ordering, specify gas to be used.

U-11-36

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

WECO

Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

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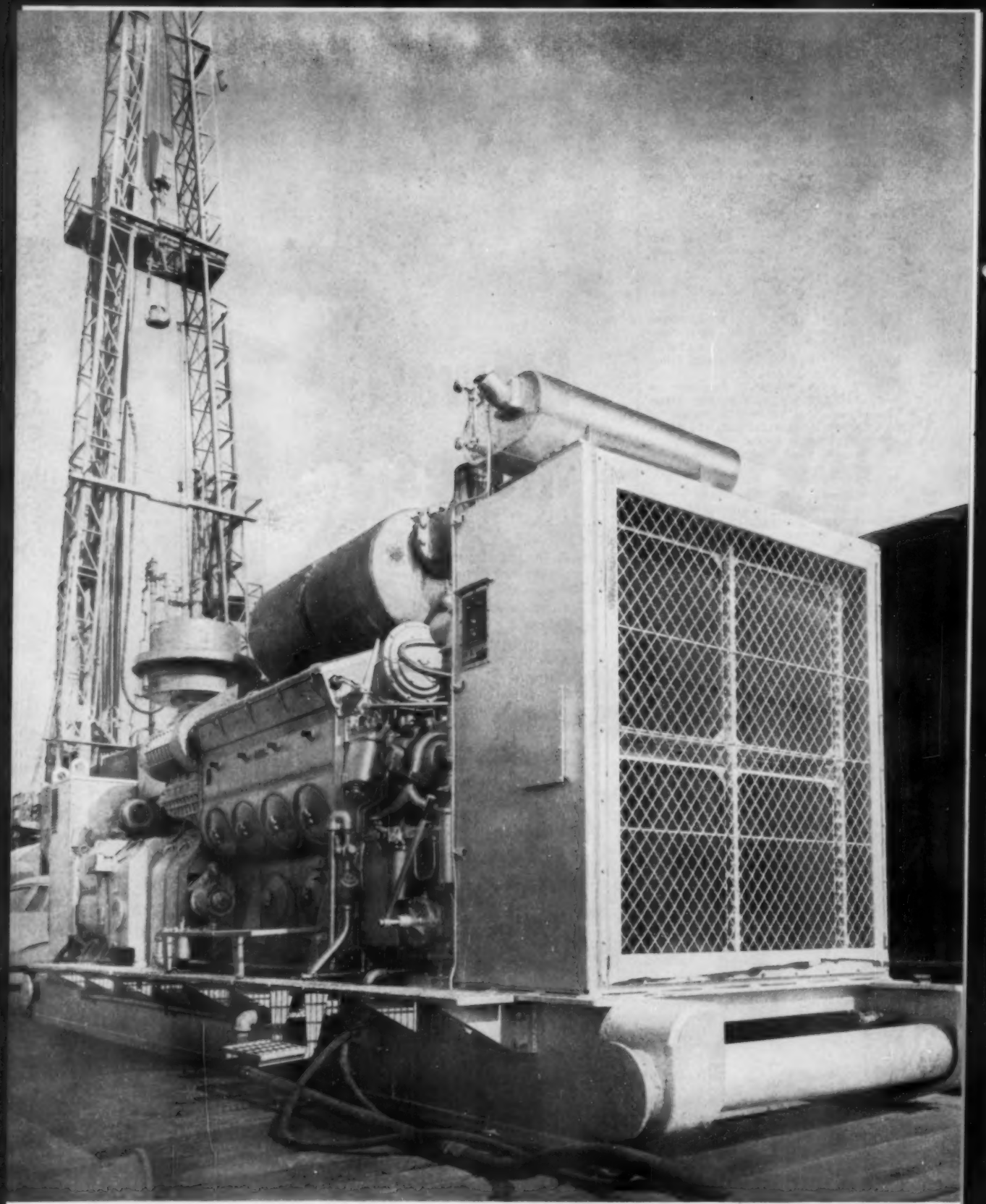


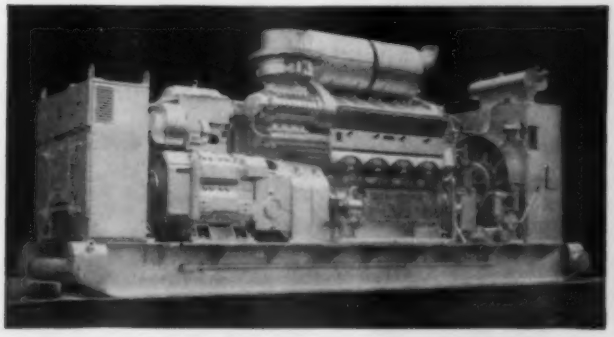
In operation on Sun Oil Company's Rig 15 at Rayne, La. is Electro-Motive's new drilling power unit, the SR-10. Main features include increased engine hp, increased generator and drive motor capacity, lighter weight, integral AC generator, simplified maintenance and load regulator control.

Announcing
a significant advancement in
deep well drilling power

New Electro-Motive SR-10 Power Unit

In 1955, Electro-Motive introduced the first fully integrated Diesel-electric power system for oilwell drilling. Success of these units is demonstrated by the fact that Electro-Motive Power is widely used by drilling companies throughout the Gulf Coast area.

Now, Electro-Motive offers another first and significant contribution to the oil industry's increasing need to drill deeper, faster and more economically—the first standardized, completely self-sufficient Diesel-electric power system. These are its features:



The SR-10 is a refinement of Electro-Motive's original plan to build a *complete* and integrated Diesel-electric system designed and built to work as a unit with one manufacturing responsibility.

For detailed specifications on the new SR-10 unit, contact your Electro-Motive representative in any of the cities listed below.

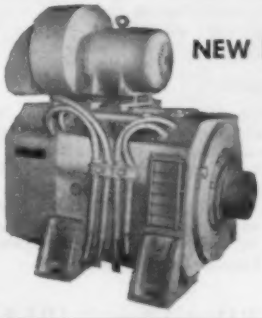
INDEPENDENT AC SUPPLY
A new integral AC generator (100-KW) makes the SR-10 completely independent of outside supply for its own AC needs—blowers, exciters, control equipment.

INCREASED POWER
Engine horsepower has been increased to 1000. New D49-G generators produce up to 640-KW each (2 per engine). New D49-M drive motors deliver up to 800 horsepower.

GREATER POWER UTILIZATION
New load regulator provides load balance between units. Thus, if power requirements exceed that available on one unit, the load regulator automatically loads a second unit to satisfy drilling demands.

REDUCED MAINTENANCE
New improved motor control cabinet is simpler and more efficient. Its new design combines with many other improvements, both electrical and mechanical, to appreciably reduce overall maintenance time and expense.

LIGHTER WEIGHT
A new speed-increasing transmission between the engine and generators and other changes have cut the weight of the air cooled unit by more than 2000 pounds.

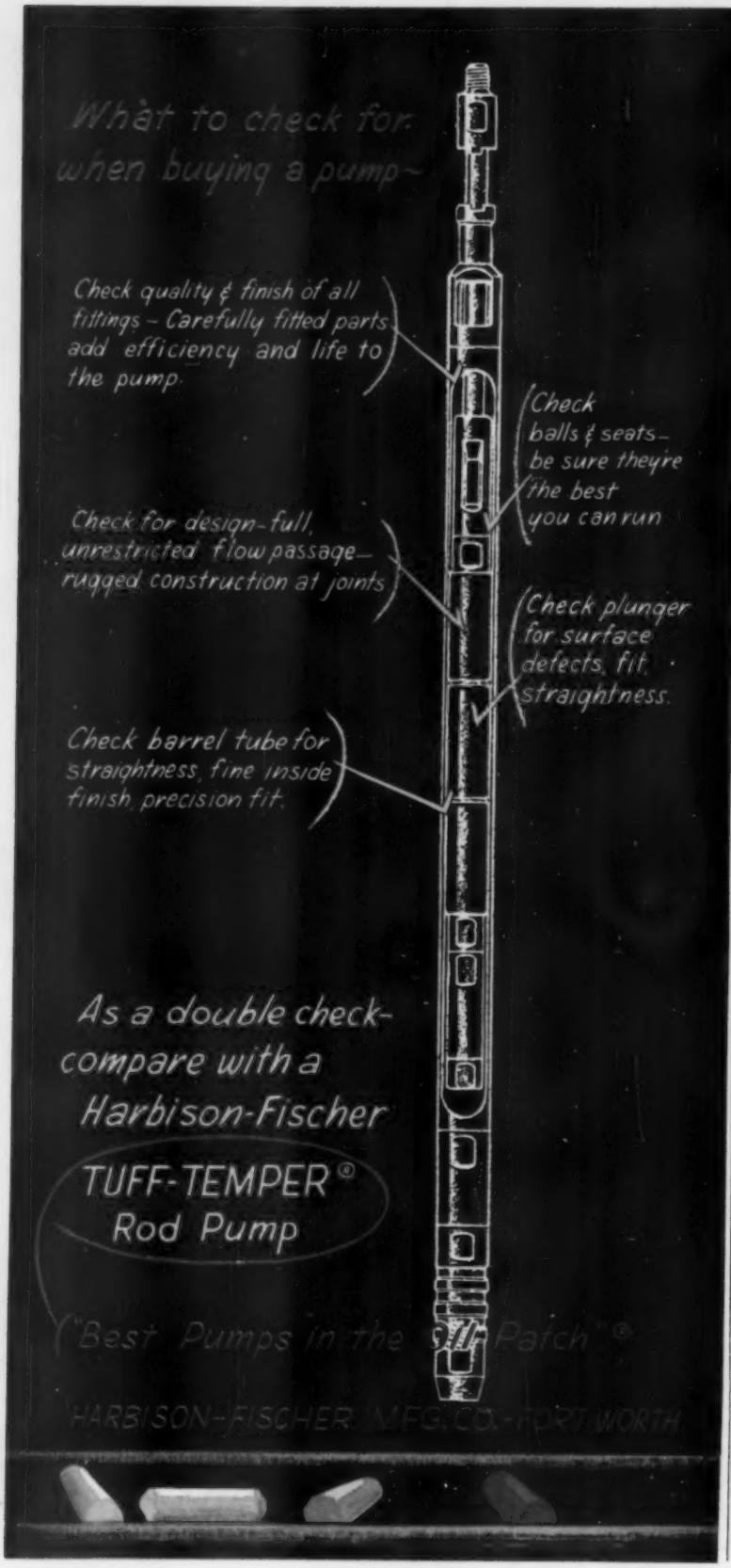


NEW D49-M DRIVE MOTOR

Improvements in design and materials of both the new motor and generator have appreciably increased horsepower and provided for better moisture protection. Motors and generators are identical except for field windings, a factor that facilitates service and reduces costs.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS • La Grange, Ill.

In Canada: General Motors Diesel Limited, London, Ontario
Petroleum industry sales offices: Dallas and Houston, Texas; Morgan City, Louisiana; Los Angeles, California.


What to check for when buying a pump—
Check quality & finish of all fittings – Carefully fitted parts add efficiency and life to the pump
Check balls & seats – be sure they're the best you can run
Check for design – full, unrestricted flow passage – rugged construction at joints
Check plunger for surface defects, fit, straightness.
Check barrel tube for straightness, fine inside finish, precision fit.
As a double check – compare with a Harbison-Fischer
TUFF-TEMPER® Rod Pump
("Best Pumps in the Patch")®
HARBISON-FISCHER MFG. CO. - FORT WORTH

basin corrosion tour, Lincoln Hotel, Odessa, Tex.

24-25 Rocky Mountain Oil and Gas Association, midyear meeting, Northern Hotel, Billings, Mont.

24-25 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

25 Natural Gasoline Association of America, southern regional meeting, Washington-Youree and Captain Shreve Hotels, Shreveport.

25-26 Abilene, Tex., Geological Society, Fort Worth Geological Society, joint field trip, San Saba County, Texas.

25-26 West Texas Geological Society, fall field trip, Glass Mountains area, Holland Hotel, Alpine, Tex.

27-29 Independent Petroleum Association of America, annual membership meeting, Statler Hilton Hotel, Dallas.

28-30 National Lubricating Grease Institute, twenty-fifth annual meeting, Edgewater Beach Hotel, Chicago.

31-Nov. 1 American Association of Petroleum Geologists, Mid-Continent regional meeting, Education Building, Fairgrounds, Tulsa.

NOVEMBER

3-8 Society for Nondestructive Testing, second international conference, Hotel Morrison, Chicago.

6-8 Gulf Coast Association of Geological Societies, seventh annual convention, Roosevelt Hotel, New Orleans.

6-8 Society of Automotive Engineers, national fuels and lubricants meeting, Hotel Statler, Cleveland.

11-14 Society of Exploration Geophysicists, twenty-seventh annual meeting, Statler-Hilton Hotel, Dallas.

11-14 American Petroleum Institute, thirty-seventh annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.

12-14 National Association of Corrosion Engineers, northwest region fall meeting, Penn-Sheraton Hotel, Pittsburgh.

22 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

DECEMBER

1-3 Interstate Oil Compact Commission, annual meeting, Tulsa.

1-6 American Society of Mechanical Engineers, annual meeting, Statler Hotel, New York.

2-6 Twenty-sixth Exposition of Chemical Industries, Coliseum, New York.

8-11 American Institute of Chemical Engineers, annual meeting, Conrad Hilton Hotel, Chicago.

JANUARY

16-18 Association of Oilwell Servicing Contractors, second annual convention, Baker Hotel, Dallas.

19-22 Pipe Line Contractors Association, tenth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

31 Natural Gasoline Association of America, regional meeting, Skirvin Hotel, Oklahoma City.

FEBRUARY

16-20 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Hotel Statler, New York.

26-28 American Petroleum Institute, Division of Production, southern district meeting, Shamrock-Hilton Hotel, Houston.

28 Natural Gasoline Association of America, Permian basin regional meeting, Lincoln Hotel, Odessa, Tex.

The *Schlumberger* Wire Line Formation Tester...

Offers reliable testing with the same speed, safety, and economy as other wire line logging services.

Formation tests are obtained with this tool when hole conditions prevent the use of other testing methods.

Pin-point testing...

The tool is set exactly at the level to be tested by correlation with the S.P. curve. This, combined with the fact that only a limited vertical section is tested, allows selectivity never before possible . . . oil/water or gas/oil contacts can be easily defined.

In one operation...

It's practical — The tool is run on Schlumberger cable anytime during drilling and at any level in the hole. This means economical testing.

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It's complete — A full set of formation pressures are recorded at the surface during testing operations. A five-gallon reservoir in the tester allows a sample to be recovered for fluid analysis.

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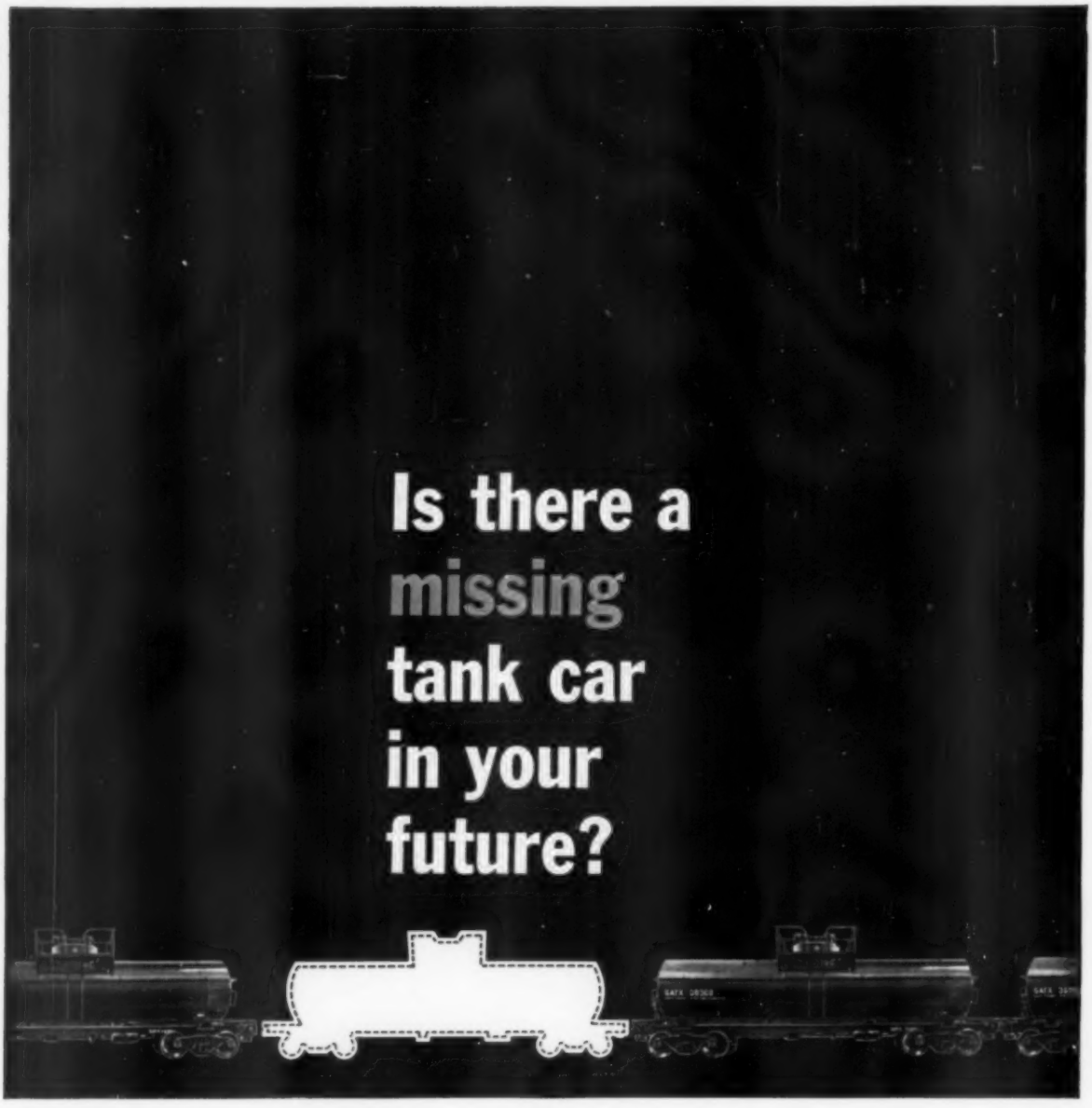

That's almost certain to be the plight of companies who don't plan for their tank car requirements in the decade ahead. It's no secret that available general-purpose tank cars are going to be limited. With normal obsolescence of today's facilities, the continuing steel shortage, and with forecasts pointing to a more than 50% expansion in our economy, *liquid product shipments may be difficult . . . may miss tomorrow's sales opportunities.*

P. S. Plan now to discuss your long-range needs with our GATX District Man. You'll find . . . it pays to plan with General American.

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135 South La Salle Street • Chicago 90, Illinois

the OIL AND GAS JOURNAL

TULSA, OKLAHOMA

Published every Monday by The Petroleum Publishing Co., 211 South Cheyenne Avenue, Tulsa, Okla. Phone Diamond 3-6291. Founded in 1902. Name changed to The Oil and Gas Journal in 1910 by Patrick C. Boyle.

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JOURNALLY SPEAKING

Where a Husband Shines

Du PONT has found one area of life where a wife usually follows her husband's advice. It took plenty of research to find, but here's the report:

Majority of wives follow their husband's suggestions in choosing a brand of gasoline, a filling station, or ordering repairs to the family car.

Does that make the filling station one of man's last retreats?

Oil-company marketing men don't think so. They're not following the Du Pont findings out the window. They still have an eye out to woman's appeal.

They would.

Shale a Sure Bet?

SCIENTISTS working on the problem claim a shale industry within a few years is a certainty.

They assess the future this way: All the shale industry has to do is sit and wait until the price of crude becomes high enough.

Mining costs already are coming down enough to be competitive. Shale can be mined and crushed for about 90 cents per barrel. Some claim the costs even can be cut to 45 or 50 cents a barrel.

Next technological problem: More efficient retorting process. Scientists say they can whip this too.

But one thing about shale. Oil companies already are in the field with both feet, and more are surveying its possibilities in the Rockies.

New Cars: A Plumber's Dream

THE OTHER NIGHT we took the family over to see the new Edsel.

The little wife sat on the seats—liked their sitability. Our high-school daughter liked the pretty colors. I poked my nose under the hood and drew it out blinking: Another plumber's dream.

A fellow has a hard time finding the motor of these new cars. They're overlaid with pipes, connections, wires, power gadgets until a sparkplug change even involves a major repair bill.

The Edsel looks like an excellent car—should sell well. But Ford engineers, like those of General Motors and Chrysler, are caught up in a madness that has infected us all. The cars are mechanical wizards—but what will our repair bills be like in a few years?

America's family man is on a spot: The wife and kids want the latest Geewhiz Super-8 with all the speed and power engineers can stack on. The old man secretly does too, but someone has to pay for it all, and who usually pays?

All this points up one major question: How long should a fellow keep a family car? Should he trade before he has to start paying big repair bills?

We threw this question at the Journal's economics editor. He indicated some sharp changes in trends of car buying may be in the making. In the past a good used car was considered a bargain. The original owner had absorbed a big hunk of the depreciation. The new owner would have less depreciation to stand and could count on moderate repair bills for awhile. But with so much to repair on the new cars, will this be true from now on?

The economist wisely commented: It's a cinch someone will pay for the depreciation and repair bills. It may mean that the trade-in value of an auto may drop. The original owner thus will be paying part of the repair bills for the second buyer. It may mean that original owners will keep their cars a little longer to spread out the depreciation over a wider base period. Anyway, it'll be interesting to see what happens.

Some young engineer with a well-lubricated slide rule can do the public a service by research on how long a fellow should keep his car. It would make informative reading—we'll even write it up for the Journal.

More Mileage on Oil

OIL MEN can count some losses with gains in the 1958 autos.

Journal editors who watch Detroit developments tell us more cars will need premium fuels, they'll burn more gasoline to satisfy needs of larger motors and power accessories. Crankcase capacity also will be up.

But the recommended intervals for changing oil may be longer—approaching 4,000 miles between changes—and there'll be fewer chassis lube fittings to service. Automatic transmission refills also will be fewer.

—*Bill Bachman.*

WARREN Resources of Production, Transportation and Storage, and WARREN'S Experience as a Specialist in its field assure you of Complete and Dependable DELIVERIES of . . .

NATURAL GASOLINE

whatever the grade and the volume

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Tax situation demands more than squawking

JOHN JONES drove the family car into the corner station and paid $3.10 for 10 gallons of regular grade gasoline. But did he?

To start with, his payment included 30 cents to the federal Government and 58 cents to the state or 28 per cent of the $3.10.

This total of 8.8 cents per gallon in federal and state taxes is an average figure. In hundreds of consuming centers throughout the country the two taxes are 10 cents per gallon or more.

But these are just the extra taxes. Ahead of them are the so-called "hidden" taxes including some not duplicated in any other industry.

There is no accepted figure as to the total of these regular taxes properly chargeable against a gallon of gasoline. But investigators agree that a charge of 5 cents per gallon appears to be justified.

This figure covers ad valorem, income, and the many other taxes paid on a basis of property value and operation. In the case of the oil business they include special assessments such as state crude-oil severance, federal pipeline taxes, and inspection fees.

The bulk of these taxes applying to the oil industry must be paid by its principal product—gasoline.

So in effect in a very real sense Jones bought $1.38 in taxes which represented 44 per cent of his total payment.

It is agreed that the oil industry's tax bill this year will exceed 6 billion dollars. This means that more than 7 per cent of the nation's taxes will come out of the coffers of one industry.

These extra and regular taxes total more than refinery price for gasoline at many plants. The tax outlays to local, state, and federal tax collectors this year will be at least 80 per cent of what domestic producers will get for supplying current crude-oil needs and for establishing proved reserves for the future.

The startling fact is that only $1.72 of Jones' $3.10 goes to the purchase of gasoline. And a sizable part of that is absorbed by the dealer's margin for the superservices at the station. What is left has to take care of a large part of the mammoth exploration, drilling, producing, transportation, and refining operations of the oil industry.

Thoughtful leaders in other industries whose tax load is a small part of that of the oil business, are saying that something must be done to stop and reverse the upward trend in taxation. Excessive taxation is a threat, they say, to the maintenance and expansion of all business.

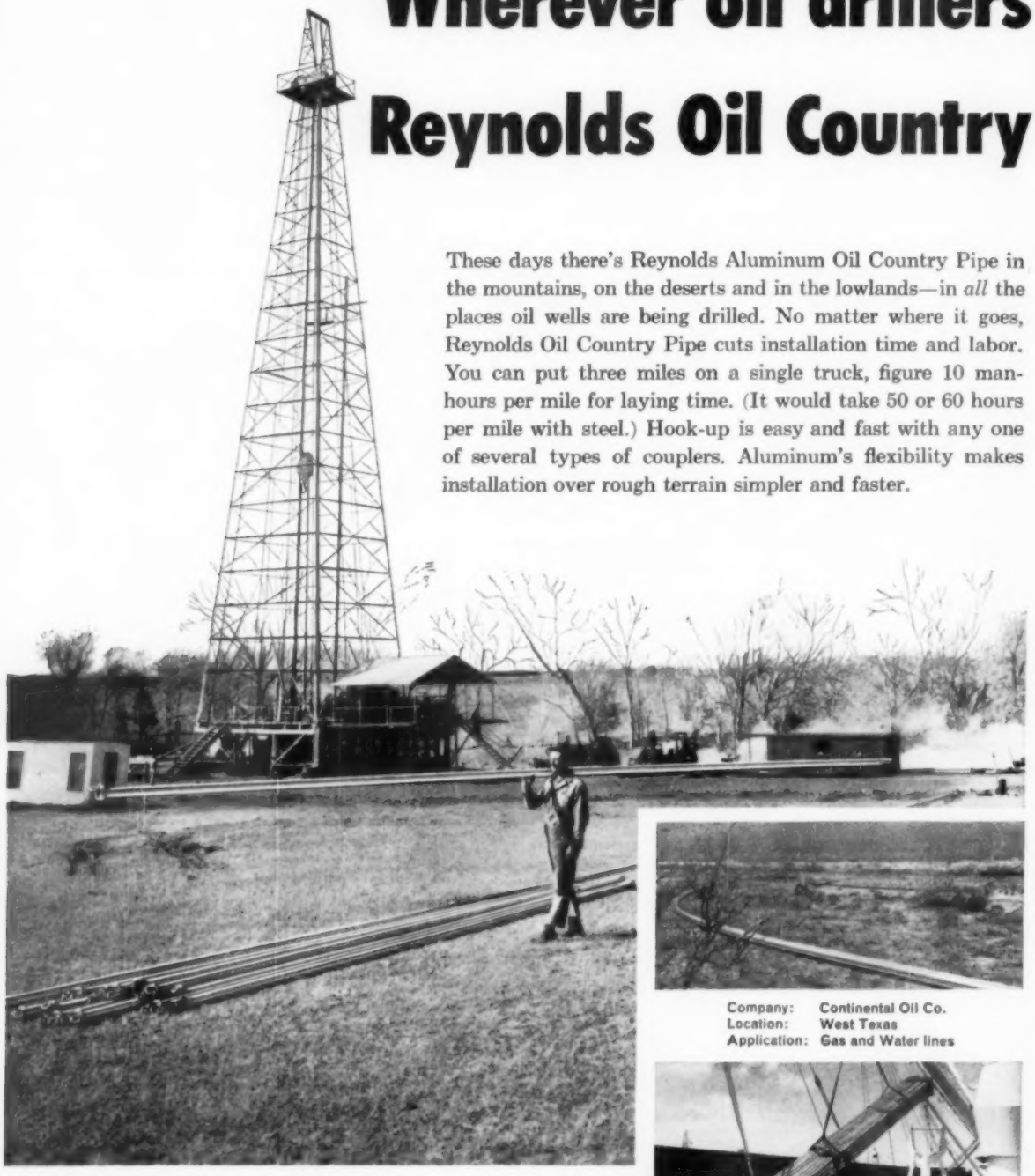
A French politician years ago defined taxation as "the art of plucking the goose in such a way as to produce the largest amount of feathers with the least possible squawking."

There is no question but what the oil industry has been plucked taxwise and it has done some squawking. But obviously not enough. In fact, with the feathers mostly gone we wonder if the time has not arrived for oil and all business to do something more than squawk.

ALABAMA, PAKISTAN, TEXAS, COLOMBIA, COLORADO, INDO-CHINA, LOUISIANA,

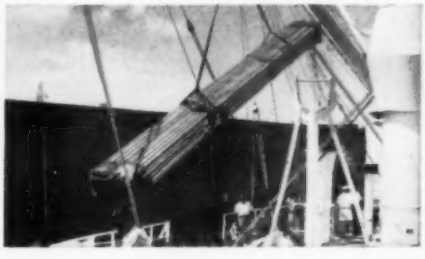
Wherever oil drillers Reynolds Oil Country

These days there's Reynolds Aluminum Oil Country Pipe in the mountains, on the deserts and in the lowlands—in *all* the places oil wells are being drilled. No matter where it goes, Reynolds Oil Country Pipe cuts installation time and labor. You can put three miles on a single truck, figure 10 man-hours per mile for laying time. (It would take 50 or 60 hours per mile with steel.) Hook-up is easy and fast with any one of several types of couplers. Aluminum's flexibility makes installation over rough terrain simpler and faster.



Company: Blanton Drilling Co.
Location: Houston, Texas
Application: Gas and Water lines

Company: Continental Oil Co.
Location: West Texas
Application: Gas and Water lines



Company: Penrod Drilling Co.
Location: Karachi, Pakistan
Application: Oil, Gas and Water lines

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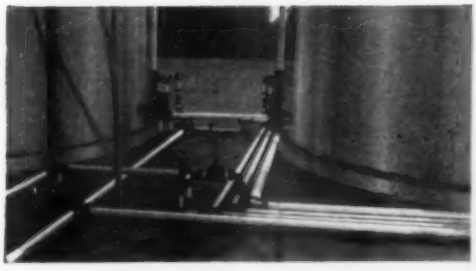
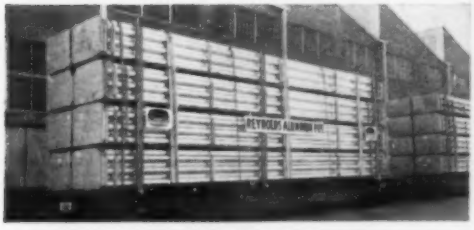
are at work, you'll find Pipe...*all over the world*



Company: Major Oil Company
Location: Citronelle, Alabama
Application: Tank Battery Hookup



Company: Columbian Petroleum Corp.
Location: Cucuta, Columbia, S.A.
Application: Crude Transmission

Company: General Petroleum Corp.
Location: Craig, Colorado
Application: Water Line

Company: Shell Oil Company
Location: Paradox Embayment
Application: Water and Gas lines

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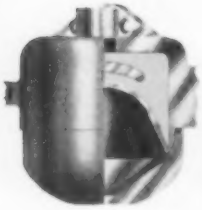
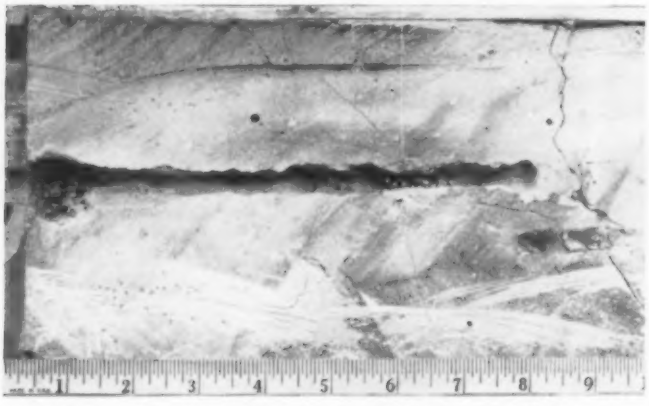


WELEX LINK-JET*

Leaves 40% Less Debris

The Welex 1-11/16" Link-Jet, the newest of the Welex jet perforators, has been designed to give more penetration with less debris than any other type tubing gun available. Engineered for use in small I. D. casing liners and tubing, the advantages of the Welex Link-Jet are many:

- Forty percent less debris than any type tubing gun.
- Greater penetration and hole size than any fixed-type tubing gun.
- Extreme flexibility permits passage through tight spots in casing and tubing.
- Elimination of debris from perforation.
- Bottom firing insures sure detonation of string.
- Unique design permits interval to be skipped at minimum expense.
- Welex Dyna-Jet principle in charge assures greater hole volume.
- Strong, light-weight construction permits perforation of large shooting zones in one run.



Welex 1-11/16" Link-Jet shot in ½" of fluid into ¾" steel plate and 14-day cement to give .40" entrance hole and 8" penetration.

WELEX 1-11/16" LINK-JET
Designed for use in Small Liners and Tubing

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Welex *of Canada, Ltd.:* **Calgary — Drayton Valley — Edmonton — Red Deer**

Company Replies Show These Import Plans for Last Half

DISTRICTS I-IV (Thousands of Barrels Daily)

Established importers—	Allocation, year ending 6/30/58	Actual July	Estimated— Aug.	Sept.	Oct.	Nov.	Dec.	6 mo.
Atlantic	58.9	66.3	61.9	61.9	61.9	61.9	61.9	62.6
Gulf	111.6	153.5	135.0	111.0	104.0	104.0	104.0	118.6
Sinclair	62.2	64.5	85.6	72.2	72.4	73.3	79.6	74.6
Socony	67.1	73.7	83.0	72.2	70.4	70.4	70.4	73.4
Standard of California*	66.8	70.7	105.9	92.0	52.4	49.6	53.8	70.7
Standard of New Jersey†	72.0	77.0	82.0	83.0	61.0	61.0	61.0	70.8
The Texas Co.	54.5	68.1	74.3	60.5	36.9	47.0	40.4	54.6
Subtotal	493.1	573.8	627.7	552.8	459.0	467.2	471.1	525.3
New importers—								
Cities Service	32.6	30.0	35.0	32.0	34.0	31.0	32.0	32.3
Eastern States	18.3	14.5	14.5	27.0	27.0	27.0	27.0	22.8
Gabriel	7.5					11.3	11.3	3.8
Great Northern	33.0	27.9	29.0	29.0	33.0	33.0	33.0	30.8
International Refining	10.9	10.9	13.0	9.0	6.0	13.0	13.0	10.8
Lakehead Pipe Line	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.2
Lake Superior	5.0	4.2	5.0	5.0	5.0	5.0	5.0	5.0
Northwestern	10.0	9.0	9.0	9.0	18.0	18.0	18.0	13.5
Phillips	12.0	16.3	11.8	12.3	11.9	13.9	10.9	12.9
Shell	7.5	5.0	5.0	5.0	10.0	10.0	10.0	7.5
Standard of Indiana	29.8	26.9	54.5	46.0	48.0	50.0	50.0	45.9
Standard of Ohio	8.2		4.0	9.2	12.0	12.0	12.0	8.2
Sun	50.4	60.9	59.6	66.3	54.9	55.4	52.4	58.3
Tidewater	34.2	72.1	114.0	62.3	61.9	52.2	63.5	70.8
Southwestern	2.9	2.6		2.8		2.8		1.2
Subtotal	262.6	280.5	354.6	315.1	322.0	334.9	337.2	324.0
Total	**755.7**	**854.3**	**982.3**	**867.9**	**781.0**	**802.1**	**808.3**	**849.3**
Others‡—								
Bay Refining		2.5		2.5	3.0	5.5	5.5	3.2
Texas Asphalt & Refining					3.5	3.5	3.5	1.7

*Includes American Bitumuls. †From Texas Railroad Commission July Imports Report. ‡Companies not included in Cabinet Committee Report.

Imports Falling, But Not Fast Enough

WASHINGTON.—The first barometer showing how the imports-control plan is working came last week. It revealed imports are dropping but not enough to stay within assigned quotas.

The meaning implied in the first monthly forecasts filed with Capt. M. V. Carson, Jr., administrator of the program, is clear: Imports won't be in line this year. Toughest part of the slimming-down job will come in the first half of 1958.

The reports from importing companies showed that December entries will be 174,000 bbl. daily under August receipts. But they still will be 52,600 bbl. above quotas.

Each report to Carson covered actual imports for July and estimates for the subsequent 5 months. Actual imports for July were given as 854,500 bbl. daily. They were estimated at 982,300 bbl. daily for August, dropping to 808,300 bbl. daily by December.

Some meet quotas . . . Four of the seven established importers and 6 of the 15 new importers will trim down even to or below their quotas by December.

The average for the last half of the year, however, will be 93,600 bbl. daily above the 755,700-bbl. goal of the government program.

Washington officials pointed out the initial forecasts are important only as showing a trend. Actual effects of the program aren't expected to appear for some months. Time must be given importers to revamp their operations. Because of this time lag, officials ex-

AN ERROR in ODM's figuring is basis of appeal for greater imports quota made by President Elmer R. Erickson, left, of Northwestern Refining Co. and his aide, John Stuteville.

pect definite showings to appear by October.

Only Standard Oil Co. (N. J.) among the old-line importers said it will get down to its quota for the last half. Jersey Standard will average 70,800 bbl. daily for the period against an allowable of 72,000 bbl. The Texas Co. will make the next best showing. But it will be 100 bbl. above its 54,500-bbl. quota.

Nine of the newcomers, however, will show averages even with or below their quotas for the 6-month period if they live up to the estimates given Carson.

Companies farthest from meeting their quotas are Sinclair Refining Co. and Tidewater Oil Co. Both have requests pending for increases in quotas. They apparently forecast imports much above their allowances in anticipation of relief.

Carson's summary of the forecasts also revealed two new importers have come into the picture. Bay Refining Corp. and Texas Asphalt & Refining Co. reported they have plans to import. Together their imports will average only 9,000 bbl. daily by November.

Hot cross-fire . . . Carson, meanwhile, found himself caught between the heavy cross-fire of competing oil interests as hearings on the program continued.

Requests for about 75,000 bbl. daily in increased import quotas are now before the import arbiter. But he also got warnings from other importers last week that substantial increases in allowable imports might upset the entire program.

These are the highlights of the hearings:

. . . Cabinet committee allocations of 755,700 bbl. daily or 9.6 per cent of domestic demand were held by Carson to be not a ceiling but an illustration of how imports should be cut.

. . . Last four of seven claimants for higher quotas defended their requests in public hearings. One company said it would not decide whether to go along with the program until its request had been passed upon.

. . . The purchase of eight million barrels of military jet fuel from the Caribbean brought charges that government agencies are working at cross purposes. Result will be a loss of 150,000 bbl. daily to domestic producers, Carson was told.

No reserve fund . . . Carson gave his interpretation of the cabinet committee's plan in denying reports that he has a reserve "fund" from which he can give relief in hardship cases and provide for newcomers in the importing field.

Two newcomers already have shown up, it was disclosed.

"If such a 'fund' in fact exists, it has not been made known to me, and I am sure no such kitty exists," Carson said.

There is some confusion as to how relief is to be handled, Carson admitted.

"I consider the text of the committee's report as my charter in the administration of this program," he said.

"My interpretation of the table (assigning individual quotas) is that it was simply an illustration of the results of the program if worked out according to a mathematical formula.

"I do not feel in adjusting inequities, if any alleged are proved to my satisfaction, that I am bound by the 755,700-bbl. figure.

"And some importers in 1956, and perhaps earlier, were not included in the cabinet report. The quantities involved are relatively small. But no reasonable person would maintain that because they are not included in the table these companies should not be allowed to continue their imports."

In making provision for relief cases and new importers, Carson said, the cabinet committee must have known that the figure of 755,700 bbl. would "have to be exceeded in some degree."

Gulf, Socal speak up . . . The warning against any broad-scale adjustments of quotas came from Gulf Oil Corp. and Standard Oil Co. of California in letters to Carson.

"Substantial increases in allowable imports based on alleged inequities can only result in a chain reaction among other importers who will petition for relief," David Proctor, executive vice president of Gulf, declared.

Gulf is closely watching the results of the seven appeals filed so far. If they lead to a change in the current program, Proctor said, Gulf would have to re-evaluate its earlier decision to comply with the program.

California Standard, in a letter signed by T. S. Peterson, president, held that the historical basis "is the most reasonable and most equitable that could be advanced."

Peterson's letter appeared to be directed at Indiana Standard, which a week earlier urged Carson to abandon the historical basis in favor of a straight 9.6 per cent ceiling on foreign crude processed by any company east of the Rocky Mountains.

Sinclair heard . . . The final four of seven companies appealing for relief were heard last week. No further requests for quota increases have been received.

Three of the four cases involved relatively small increases, all asked on the ground of errors in estimates on which quotas were based.

But Sinclair Refining Co., the last to be heard, told Carson that unless its quota is raised from 62,200 to 74,800 bbl. daily, "it is not in a position to accept the request made upon it" to hold imports down.

"We appear with the understanding

that we are reserving any decision or commitment of any kind until after our appeal has been considered and disposition made of it by the Government," J. E. Dyer, Sinclair president, said. The belief that national security is threatened by imports has never been supported by findings of fact, Dyer argued. In fact, he said, there is "substantial and competent evidence" to the contrary.

Dyer said, however, that Sinclair favors the voluntary restraint of imports to a reasonable relationship to domestic demand. He pointed out that Sinclair buys 60 per cent of its crude from domestic independent producers, as against an average for all established importers of 33 per cent.

Sinclair's plea for an increase is based on its foreign operations. It has substantial oil becoming available in Venezuela this fall with completion of a pipeline. If this oil can't be brought into the U. S. the company's future raw material supply will be seriously prejudiced.

Contracts for the purchase of other crude which must be met would make it necessary for Sinclair to keep its own reserves in the ground if its quota is not raised. These contracts must be honored, Dyer pointed out.

At the same time, Sinclair's relations with foreign governments from which it holds concessions may be seriously impaired if it cannot produce discovered oil, Dyer said.

Dyer pointed out that Sinclair has always complied with the Government to keep imports down. The effect of that cooperation, under its present quota, would be to penalize Sinclair for its help and tend, in effect, to discriminate in favor "of some who did not comply with earlier requests."

Errors in estimates . . . Mistakes have led to unduly low quotas for three importing companies.

In the case of Northwestern Refining Co. the error was on the part of the Office of Defense Mobilization, Elmer R. Erickson, president, charged.

The ODM failed to contact Northwestern when it asked importers to file their plans last June, Erickson said. As a result, its quota was figured on an old estimate of 10,000 bbl. daily instead of 13,500 bbl. He asked that the quota be increased.

Military buying hit . . . A mistake in reporting which left out 4,500 bbl. daily of crude now being imported from American Independent Oil Co. left Eastern States Petroleum & Chemical Corp. that much short in its quota, Richard B. Kahle, president of the company, revealed.

This oil was being sold in Japan until the end of June, Kahle explained. Now Eastern States has no foreign buyer for it and is forced to bring it into this country. But it failed to take this into account when preparing its estimates, he said.

Eastern States is asking to have its quota lifted from 18,300 to 22,800 bbl. Even this, he said, will not cover the company's contracted imports of 4,500 bbl. from American Independent and 22,000 bbl. of Kuwait crude from British Petroleum Co. But it may be possible to make an adjustment of these contracts, he admitted.

Kahle bitterly attacked the purchase of military jet fuel in the Caribbean (see p. 78).

Shutdown omitted . . . An error by the ODM in figuring the effect on 1956 imports of a 1-month shutdown resulted in giving International Refineries, Inc., a 10,900-bbl. quota, Henry M. Baskerville, president of the company, reported. Actual imports were 1,300 bbl. a day over 11 months, he said. But the quota also made no allowance for a 2,000-bbl. increase in refinery capacity. The right quota would be 14,000 bbl. a day for the last half of 1957 and 15,000 bbl. next year, he claimed.

Baskerville explained that the refinery at Duluth has to depend largely on Canadian oil brought in through the Interprovincial Pipeline. International supplies fuel oil to steel mills which require a very low sulfur content and only Canadian crude of the proper grade can be had. The domestic crude, available only in limited supply by tank car from the Williston basin, has too high a sulfur content.

New Unit Halts Steam Cloud

LOS ANGELES.—What price public relations in smog-conscious Los Angeles?

General Petroleum Co. has just spent $500,000 at its Torrance refinery to eliminate a steam cloud that's visible to the heavily populated area but wasn't a real contribution to air pollution.

The steam cloud, which had a slight antiseptic odor, resulted from the thrice-daily cooling cycles on the refinery's coking units.

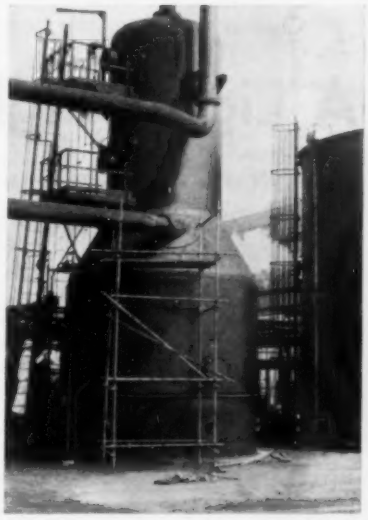
But General Petroleum decided to go along with the industry-adopted idea that refineries should, where possible, be "unseen, unheard, and unsmelled."

The company spent a year on research and design to develop a coker blowdown unit. The new system, now in operation, is unique in the Los Angeles Basin, where only General Petroleum operates a coker. The setup is fully automatic and services six coke units.

What it does . . . In operation the unit consists of a cooling system which condenses to water the exhaust steam from the coke-drum blowdown. During the process, even the smallest oil particles are separated out. The water then is disposed of through the plant's water recycling system, and materials which cannot be condensed are flared in smokeless incinerators.

Exhaust from the coke drum consists of steam, oil vapor, tar, and noncondensables. During the cooling cycle the exhaust is sent to a knockout drum.

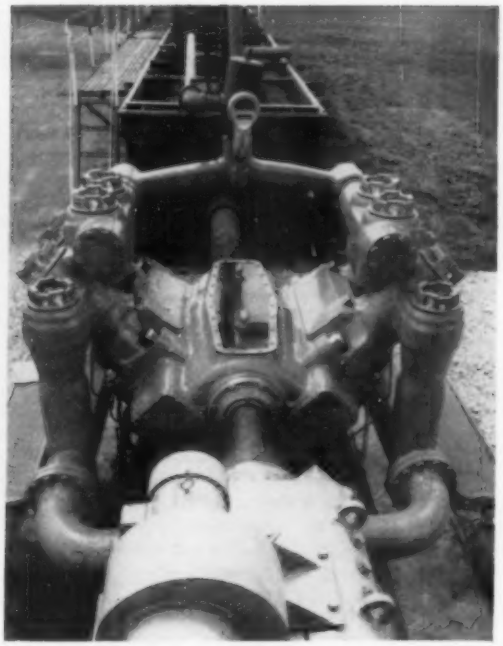
Entrained tar is removed en route to the knockout drum or while in it. Steam, light gas-oil vapor, and noncondensables are sent by overhead line from the knockout drum to an air condenser, where the vapors are cooled, and the steam and gas oil are condensed and subcooled. The condenser has fins attached to the tubing to increase the amount of cooling.



THIS coker knockout drum helps eliminate steam cloud at Torrance refinery.

The condensate is sent to water strippers. The light gas oil flows by pressure to an oil settling tank, and the noncondensables are flared.

The tar-gas oil mix in the knockout drum is blended with some light gas oil to improve settling qualities and oil-water separation. Then it is pumped to the settling tanks.



Owner Mecom (left) and Manager Courtney show off Cardwell's new baby . . .

A Lightweight Pump for Heavy Duty

HOUSTON. — Cardwell Manufacturing Co. last week took the wraps off its new rotary-drilling mud pump which it claims is the greatest innovation in the field in the past 40 years.

Known as the Cardwell V-1500, the pump introduces a drastically new design featuring four-cyclinder, V-type construction. The company claims the unit is "the world's highest capacity slush pump" and "the world's lightest weight pump per horsepower."

The new unit weighs approximately one-third as much as conventional pumps in the large horsepower class. Size also has been greatly reduced. It is about 7 ft. long, 7 ft. wide, and 7 ft. high. The unit weighs about 23,000 lb.

To combine high horsepower with light weight, Cardwell turned to the aircraft industry for engineering assistance in developing the new unit. The V-1500 can utilize 1,500 input horsepower, yet weight has been held to 15½ lb. per horsepower.

Most conventional pumps can use a maximum of 1,000 hp., although a few late models are rated at 1,250, Cardwell officials pointed out. Weight of conventional piston-type pumps ranges from about 44 to 60 lb. per horsepower.

Design and construction of the pilot model have been under way for several years at Cardwell's Wichita, Kans., manufacturing plant. Work was accelerated after purchase of Cardwell by John W. Mecom, Houston oil operator, 20 months ago. After completion of the first unit, it was shipped to the Mecom ranch near Houston where extensive testing has been conducted during the past 3 months under field conditions.

Available soon . . . Production of the pump will start at the Wichita plant in the near future. First units are expected to be available early in 1958.

Paul Courtney, general manager of Cardwell, said the new pump will be competitive in price with conventional pumps on a horsepower basis.

Because of its relatively small size and light weight, the Cardwell pump is said to be especially suitable for marine drilling. Cardwell officials also claim that it will have another advantage on marine drilling rigs because its V-type construction eliminates the horizontal movement of conventional pumps.

Courtney emphasized, however, that Cardwell officials feel that the new product "fills a definite need" not only for offshore operations but also for deep jet-bit and big-hole drilling on land.

Normal operating speed of the Cardwell unit is 260 strokes per minute as compared to only 60 to 65 strokes per minute for conventional pumps, company officials pointed out. At recommended operating speeds it can pump from 626 to 1,114 gal. of drilling fluid per minute with maximum pressures changing from 2,000 to 3,500 psi.

At last week's preview the pump was powered by an Alco Products, Inc., diesel-electric unit. However, the pump, by use of a chain drive, can be incorporated with other types of rig power units.

Emphasizing the need for improvements in slush pumps, Courtney quoted from a recent address to the Petroleum Equipment Suppliers Association by Jack H. Abernathy, president of American Association of Oilwell Drilling Contractors. Abernathy was quoted as saying that the pump "is perhaps the most costly and least satisfactory tool on a rig."

Courtney pointed out that the high costs of operating today's rigs "have made drilling contractors acutely conscious of the inefficiencies of much of their equipment.

He said that the new pump "is the first of a complete line of pumps and many other new products being planned by Cardwell for the oil industry." He said some of the new products now on the drawing boards will introduce "entirely new techniques to the industry."

Deep Well Deeper

Texas record-breaker is near 20,500 ft. mark

FORT STOCKTON, Tex.—Texas' deepest test was approaching its contract depth last week but was making hole easily and is expected to go still deeper.

At midweek, Pan American Petroleum Corp. 1-CS University in Pecos County, West Texas, reached 20,461 ft. on its contract for 20,500 ft. It was still making up to 60 ft. a day in the Barnett shale of Mississippian age.

The remote wildcat, 13 miles southeast of Fort Stockton, is aiming for the Devonian.

It is believed likely, with drilling going as easily as it is, that Pan Am will amend the contract and keep on going. The company need only make up its own mind on this score, since the venture now is wholly Pan Am's. Gulf Oil Corp. had a one-half interest in the venture down to 17,000 ft.

A Pan Am spokesman told the Journal last week that at present depth the bit at the 1 University is drilling at an angle about 11° off vertical. Operator decided at about 17,000 ft. to gain drilling speed by applying more weight and letting the bit drift.

The deviation angle has increased since that time from about 1° to the present 11°. Rate of deviation has been gradual, however, and the company has had no trouble going in or out of the hole.

Prime concern now is the possibility of heavy hole caving. Operator set the last string of casing, 7⅝-in., at 16,478 ft. It now is carrying almost 4,000 ft. of open hole, almost all of it in shale.

Douglas Takes Over Apex

DOUGLAS OIL CO. of California has acquired 98.8 per cent of Apex Petroleum Corp., Ltd., and will operate Apex as a subsidiary.

The purchase doubles Douglas' net crude-oil reserves. Apex has 66 producing wells in California's West Wilmington, Signal Hill, and Anaheim fields. Another 25 wells are scheduled for early completion.

Douglas President W. G. Krieger said Douglas used a combination of 5½ per cent 12-year convertible debentures and cash to obtain nearly all Apex's common stock not previously acquired.

New officers of Apex include George T. Goggin, president; T. A. Atkinson, executive vice president; and J. M. Jackson, vice president.

watching WASHINGTON

. . . with Bertram F. Linz

Public power still has a jolt . . .

PUBLIC power, beaten down in the case of Hells Canyon Dam, is far from dead. And oil men should keep an eye on bills, one already passed by the Senate, that would make it more of a giant than ever.

These bills would let the Tennessee Valley Authority issue tax-exempt bonds, backed by the Government. TVA could sell them to both the public and the Government. The wraps would be taken off TVA and there would be no limit on its expansion. On top of all this, Congress could still provide additional funds.

The natural-gas, oil, coal, fertilizer, and insurance businesses have taken a licking in the area now covered by TVA. More than 180,000 homes will be heated this winter by government electricity made at the taxpayers' expense. The use of natural gas in TVA's area is growing at a much slower rate than in areas much farther from production.

The first step toward easing the reins on TVA would be a $30-million revenue bond issue to pay for adding another unit to the generating plant. What industries already hurting fear is that this might open the door for a new drive to expand TVA's service area.

Helium waste worries scientists . . .

CHARGES that the United States is wasting a natural resource on which it has a world monopoly may lead Congress to do something about helium next year.

The charges were raised at a recent meeting of world scientists. Their interest stemmed from the fact that helium is highly valuable in some fields of research in which nothing else will serve as well.

But Interior Department officials are also concerned. Helium is found in a number of producing gas fields in the Southwest. But only a small part of the output is being processed to get it out, all in the Bureau of Mines plants. Most of the helium is sold to the military.

The department recently has thought of getting out of this business, turning the plants over to private enterprise. That would pave the way for extraction plants in other fields to save the helium now lost.

The stumbling block is the limited market. It is doubtful that a company would be willing to sink millions into a business dependent on sales to the Government.

Good-faith case comes back . . .

THE U. S. Supreme Court opens its new term next month with a well-known issue before it again.

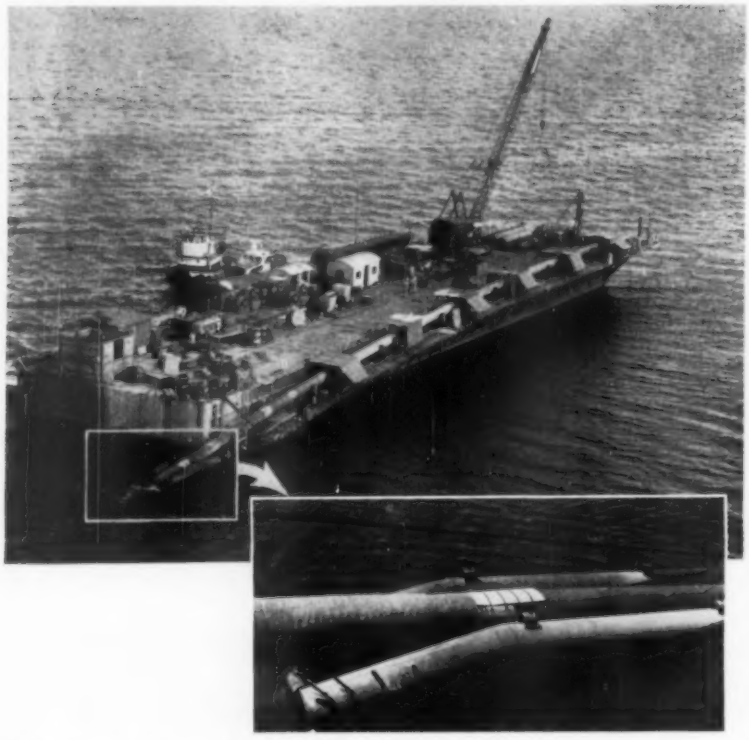
The hoary Standard Oil Co. (Ind.) "Detroit case" (it was started by the Federal Trade Commission in 1940) is going through the legal wringer for the second time. It involves the question of whether the cutting of prices to selected customers to meet competition in good faith violates the Robinson-Patman Act. Some years later the FTC said, and still says, it does.

The case came to the Supreme Court the first time on appeal by Indiana Standard from a Chicago court which upheld the FTC. In 1951, the top court issued its famous ruling that if made in good faith, such price cuts were legal.

The FTC went to sleep on the suit for a couple of years, then woke up to issue a new order. Recently the same Chicago court shocked the commission by throwing its order out. This time, the Government appealed.

What the court does with the case next year will be important. But equally so will be what Congress does. Since 1951, the patron saints of small business have been trying to jam through a bill strangling the good-faith defense. The court may act before Congress quits next year.

"Stinger" Solves a Problem:



350-ft. cradle guides pipe to sea floor without bending. Constant slope all the way down is the secret of . . .

New Pipe-Laying Technique

PIPELINERS working in offshore Louisiana have found a way to lay pipe without cracking the concrete-aggregate coating.

The newly-developed method prevents bending of pipe and gently channels it into the 60-ft. waters of the Gulf of Mexico.

Brown & Root, Inc., is laying the pipeline grid for Tennessee Gas Transmission Co. off Cameron Parish, Louisiana (OGJ, Apr. 22, p. 84).

The new wrinkle used by Brown & Root is called a "stinger." It is a two-pronged 352-ft. launching device that acts as a cradle for slanting the pipe joints at the proper angle into the water from the lay barge.

This operation is important because the thick concrete coating on the pipeline must not be cracked. The coating helps to offset the natural buoyancy of the pipe and prevents marine organisms from attacking the pipe itself. If the pipe is bent and cracks appear, destructive marine life would have natural access to the pipe.

The "stinger" is particularly effective in deep waters where distance is great from the barge to the point where the pipe touches the ocean floor. The 26-in. pipe is heavy-walled, and this extra weight, coupled with the weight of the concrete coating, creates greater danger of bending.

Other techniques to prevent bending have been used in the gulf, but Brown & Root says the "stinger" is especially valuable because adjustments are needed only to achieve the desired slope. The slope changes only when there is a marked deviation in the water depth.

How it works . . . The "stinger" consists of two parallel lengths of 30-in. pipe, each 352 ft. long. These sections are joined to form a cradle and are equipped with dollies along their entire length.

The dollies are underslung so that the pipe travels along them between the two 30-in. prongs.

The device can pivot on the barge launching ramp, and the far end is free to move with the weight of the pipe string. Each prong is divided into eight compartments which may be flooded or emptied through a valve system. This provides a proper amount of ballast.

Where used . . . Brown & Root has equipped two of its three barges on the T.G.T. line with the new launchers, and the third will get the equipment this week.

The three spreads have reached the halfway point on the pipeline grid, which will tap 1.7 trillion cubic feet of gas reserves now being developed by the C.A.T.C. group. The gas will be moved from several offshore platforms to converge at Block 49, where a 25-mile section of 26-in. pipe will carry it to shore.

Once ashore, the gas is transported another 46 miles to a T.G.T.-main line near Kinder, La.

Brown & Root has the contract to lay all the offshore lines. Work started July 8 and is scheduled for completion by November 15.

Deep Pay Is Found

Record production depth reached in Oklahoma pool

BRITISH-AMERICAN Oil Producing Co. apparently found commercial production last week nearly 1,000 ft. deeper than ever before established in Oklahoma.

The company's 1 Kriger in the Knox pool of Grady County flowed up to 7,600,000 cu. ft. of dry gas daily during a test of the Oil Creek perforations at 16,582 to 16,612 ft.

The test was conducted with ¼-in. top and bottom-hole chokes, and with a 7,080-ft. water cushion. Water reached the surface in 17 minutes and gas in 33 minutes. Flowing gas gaged 7,600,000 cu. ft. at a surface pressure of 3,400 psi. an hour and 16 minutes after tool was opened.

British-American then switched to a ⅛-in. choke. Gas flow gaged 4,100,000 cu. ft. daily and surface pressure 5,000 psi. when checked an hour and 45 minutes after tool was opened. The tool was closed 4 hours and 9 minutes after start of the test.

Initial flowing pressure was 7,530 psi. and final flowing pressure 7,600 psi. Shut-in bottom-hole pressure was 9,500 psi. after 1 hour.

B-A plans to test the well further in the next few days and then move back up the hole and complete in the Bromide sands which flowed wet gas in earlier tests of intervals between 14,800 and 15,215 ft.

The Oil Creek, if it proves out in

further tests as appears likely, probably will be shut off and attended to sometime in the future.

B-A geologists were disappointed that the Oil Creek production was dry gas. They had hoped that a formation so similar and close to the Bromide would yield wet gas also.

Demand to Stay Put

No gain in '58, but a jump after that is predicted

NEW YORK.—Don't look for an increase in total demand next year.

Domestic demand will be up 2.1 per cent, but this will be offset by a drop of perhaps 40 per cent in exports.

After a slow 1958, however, demand will begin picking up in 1959 and keep rising through 1961.

That's the prediction of Bronce L. Ray, vice president, director, and executive committee member of Esso Standard Oil Co., and Malcolm P. Murdock, vice president of Ethyl Corp. The forecasts were made last week at the fifth marketing conference of the National Industrial Conference Board.

Ray thinks next year will be "a trough between peaks." He sees "a small rise in motor fuel and jet fuel, no change in aviation gasoline, a slight decrease for kerosine and heavy fuel, and a small increase in middle distillates and other products such as asphalts, waxes, and lubricants."

The big drop in exports next year, Ray said, will merely reflect their return to normal. This year the Suez crisis created a tremendous demand for U. S. products overseas. This demand no longer exists.

Murdock said total demand should begin a steady rise in 1959. Exports, he said, should decline slowly, but domestic demand should rise at an annual rate of 4.1 per cent during the 3-year period through 1961. He predicts domestic demand will reach 10,400,000 bbl. per day in 1961, compared with slightly less than 9,000,000 bbl. this year.

HOW ESSO SEES 1958 DOMESTIC DEMAND

(Thousands of barrels daily)

Product—	1957	1958	Per cent change
Motor fuel	3,570	3,670	2.8
Aviation fuels*	440	460	4.5
Kerosine	307	301	—2.0
Distillate	1,742	1,776	2.0
Residual	1,525	1,510	—1.0
Other products	1,357	1,416	4.3
Total	8,941	9,133	2.1

*Includes jet fuel.

Record pressure conquered as . . .

Deepest Offset Is Completed

NEW ORLEANS. — The world's second deepest producing well has been completed with the highest wellhead pressure on record.

Shut-in tubing-head pressure soared to 12,100 psi. at Richardson & Bass' 1 Humble-Price State Lease 2345. The well, generally acclaimed as the world's deepest offset, is in Plaquemines Parish, about 2 miles east of the deepest hole ever drilled.

Shut-in pressure was 500 psi. greater than the 11,600 psi. recorded early this year at Union Oil & Gas Corp. of Louisiana's 2 Elue Roach in Jefferson Davis Parish.

Drilled to 20,186 ft., the 1 Humble-Price was completed through perforations at 19,151-74 ft. Through a ⅛-in. choke the well flowed at the daily rate of 861 bbl. of oil with 0.2 per cent mud. Flow also included 1,968 M.c.f. of gas.

Flowing tubing pressure, with the well producing through a ⅛-in. choke, was 10,700 psi. when the choke was cut down to 6/64-in.

Bottom-hole pressure, perhaps the greatest ever encountered by a drilling bit, was calculated at about 18,375 psi. The calculation is based on the mud weight and depth of the hole.

It looks good . . . The well is much more promising than its heralded predecessor, which set the world's depth record.

The record holder, Richardson & Bass 1-L Humble L.L.&E., was bottomed at 22,570 ft. It produced 206 bbl. of oil per day from perforations below 21,400 ft., but tubing-head pressure when the well started flowing oil reached a peak of only about 7,000 psi. Since then, the earlier well has been recompleted in a shallower sand at about 20,740 ft. Both pressure and production have dropped.

The new well started flowing into the tank late September 14. High pressures were apparent when the well was induced to flow merely by cutting the mud from 18.5 lb. to 16 lb.

The well was equipped with a 30,000-lb. test Grayloc christmas tree.

Tests showed a gas-oil ratio of 2,286 to 1. The oil tested 39.7° gravity.

Who's involved . . . Besides Richardson & Bass, the operator, others with an operating interest in the new well are John W. Mecom, J. Ray McDermott, Inc., and Freeport Sulphur Co.

Overriding royalty interests are held by Humble Oil & Refining Co., R. F. Price, and Louisiana Land & Exploration Co.

Richardson & Bass moved to the location in May 1956 after completing the record-depth well nearby (OGJ, May 14, 1956, p. 101). The new operators took over an abandoned well which had been drilled at the site to about 11,800 ft. 2 years earlier.

After deepening the hole to below 18,500 ft., the rig was moved back to the record well for a workover.

Once drilling was resumed, the operators had to sidetrack the hole to reach the prospective pay zone. Cost of the well has been estimated at about $2,500,000.

Texas Cuts to 12-Day Schedule

AUSTIN.—Texas oil producers will absorb another drastic cut in allowables for October.

The state Railroad Commission last week cut the number of producing days permissible to 12—an all-time record low for Texas.

The result will be an estimated production of 2,964,062 bbl. daily for the month. This represents a cut of 163,444 bbl. daily from the initial allowable for September and 219,795 bbl. daily from the allowable in effect on September 7.

Little vocal opposition was voiced against the 12-day schedule for October. Texas has been operating under a 13-day plan for 4 months.

Recommendations ranged from keeping the current 13-day producing schedule to slicing it to 10 days. Such a drastic cut would have meant a slash of more than 500,000 bbl. daily.

One independent recommended that the commission cut the allowable to 11 days. Reason given was to avoid further pipeline proration by oil buyers who report their storage is full.

Meanwhile, New Mexico officials kept that state's allowable for October at the record low figure of 37 bbl. daily per well for the second straight month. This will result in over-all daily production of 300,096 bbl. plus any supplemental allowances granted later.

Union Backs Home-Care Hospital Plan

Texaco workers at Bayonne are sold on this new type of insurance and have recommended it to Denver

Here's what they like about the home-care plan:

1. **It adds 20 per cent to the cost of the normal medical-surgical plan, but reaps big savings on hospital bills.**
2. **You get well faster and get better care by staying at home rather than going to the hospital.**
3. **It pays 75 per cent of the costs on long and major illnesses even during retirement.**

OIL COMPANIES soon may be asked to kick in on a new-style health-insurance program.

Union labor is showing interest in a "home care" hospital plan that will help give cradle-to-grave medical service at little extra cost.

Home care is simply a program in which the patient is kept at home as much as possible. Hospital services, such as visits from physicians and nurses and the use of equipment, are provided in the home. This cuts medical costs, and its supporters claim it speeds recovery.

In short, home care is an extension of the hospital to the home.

Interest in the plan is being promoted by the Bayonne, N. J., local of the Oil, Chemical and Atomic Workers. On its own, the Bayonne local broadened the basic insurance program already in effect at The Texas Co.'s marine terminal in Bayonne.

The local has brought the plan to the attention of O.C.A.W. headquarters at Denver, and it's fairly certain that O.C.A.W. will make it a point of discussion when contract renewals come up again.

The Bayonne plan covers 250-odd employes at the marine terminal. It consists of the New Jersey Blue Cross for hospitalization and New Jersey Blue Shield for medical and surgical care. The union supplement, added a year ago, is major medical or catastrophe coverage obtained through Connecticut General Life Insurance Co.

The broadened insurance program has these additional benefits:

...**Coverage** of children of employes from birth, until they leave home.

...**Coverage** for all types of illnesses, including mental.

...**Coverage** of the employe after retirement, when medical expenses likely will be greatest.

Connecticut General was induced to come into the plan after the nearby Jersey City Medical Center started a home-care program. This reduces hospitalization costs substantially and almost invariably brings swifter recovery of the patient.

The purpose of home care, according to the Bayonne local, is to "restore to family surroundings those patients who would benefit by a change from hospital to home. This would be, of course, on a strictly voluntary basis."

The cost . . . The added benefits of major medical and catastrophe coverage under the Bayonne plan cost less than 20 per cent above the basic Blue Cross and Blue Shield protection.

T. J. O'Leary, who is chairman of the Bayonne local's welfare committee, believes the figure can be shaved even more. O'Leary is the ramrod of the plan and has worked for an improved health-insurance plan for union members for years.

Here are the monthly costs of the plan at Bayonne:

	Basic plan	Supplementary plan	Total cost
Employe only	$3.90	$0.70	$ 4.60
Employe with 1 family member	9.10	1.61	10.71
Employe with 2 or more family members	11.20	1.98	13.18

The employer contributes $1.32 per employe or $2.82 per family to the basic plan. The employe pays the full amount of the supplementary plan.

The supplementary plan provides that the employe shall pay the first $100 above the payments made under the basic plan (Blue Cross and Blue Shield). After that he pays 25 per cent and Connecticut General the remaining 75 per cent up to $10,000.

What it covers . . . The supplementary plan covers a wide variety of services for long-term and major illnesses, both in and out of the hospital. Among them are these:

Treatment by a physician or surgeon, hospital charges for bed and board (not to exceed $25 per day), necessary supplies and services, services of a trained nurse, medical and surgical supplies, anesthesia and its administration, X-ray and other diagnostic laboratory examinations, radium and radioactive isotope treatment, blood transfusion including blood and blood plasma, oxygen and other gases and their administration, use of iron lung and other equipment, physical therapy, and ambulance service.

Success of the Jersey City Medical Center's home-care plan has made possible the wide range of long-term benefits guaranteed by Connecticut General.

The union local says a survey of 40 hospitals which now use the plan shows the range of ailments handled by home care is almost unlimited. The treatment is "very satisfactory" and makes possible the release of scarce and expensive hospital beds for patients who need them.

Practical experience of the hospitals shows that the length of hospital stay is reduced, and the patient is maintained at home at a cost less than one-fourth that of hospital care.

Some 50 hospitals, including 20 in New York, now operate home-care programs. Most are in the East, but one is in the South.

A Peoria, Ill., institution, the Visiting Nurse Association, cites three cases where home care brought tremendous savings. The cost of home care ranged from $200 to $575 for the three, but hospital care would have amounted to $3,384 to $3,936 at minimum rates. Duration of the illnesses ranged from 282 to 328 days.

Better for patient . . . Here is what the Jersey City Medical Center says: "In our experience, as with all other similar programs, there is a vast improvement in the sick patient who is

treated at home. Hope and material comfort, cheerfulness and reassurance, and the whole tonic effect of 'morale' are partly responsible; but in addition there is the more actual attention paid to the patient when he is in need, not according to rigid schedules.

"We have been impressed with the unbelievable speed and degree of recovery of the patient transferred to his own home.

"During the month of April 1957, we carried a census of patients whose costs could be accurately estimated. It shows a cost per patient per month of approximately $70. This is in contrast to the estimated $600 per patient per month on in-patient costs of $20 per day."

Other major insurance companies have taken an interest in the Bayonne plan. Prudential Insurance Co. of America says the theory of home care is unquestioned and, while Prudential has not yet underwritten any plan comparable to Connecticut General's, it is studying the Bayonne experiment.

O'Leary says that one of the weaknesses of most health plans is that they encourage people to seek costly hospitalization. The strength of the Bayonne plan is that it encourages patients to stay home, where they can get better care at less cost.

Higher Tax Talked

Colorado senator orders study of oil and gas tax

DENVER.—An influential member of the Colorado Legislature has called for a study of the state's so-called severance tax on oil and gas production which may lead to an increase in the levy.

"We ought to take a look at oil production as a possible source of added revenue," Sen. Herrick Roth of Denver, senior member of the joint-legislative subcommittee on appropriations, said.

"We are now giving a rebate based on taxes paid by oil producers to other political subdivisions, like counties," Roth added. "The same advantage is not given an ordinary business, which must pay its full property and income taxes."

The present severance levy actually is an income tax on value of oil and gas at the wellhead. The rate graduates up to 5 per cent on larger production volumes and yields taxes totaling about $5 million annually.

Roth said there is some question in his mind whether the oil and gas industry needs a graduated tax.

Main-line valve is lowered in place and . . .

Trans-Canada Gas Moves East

WINNIPEG. — Trans-Canada Pipe Lines, Ltd., is in the gas business at last.

Trans-Canada sold its first Alberta gas last week in Regina, Sask. This week gas will reach Winnipeg, the first major market on the line which by the end of 1958 will extend 2,294 miles from Burstall, Sask., on the Alberta border, to Montreal. Other customers on this 574-mile, 34-in. western section include Swift Current and Moose Jaw, Sask., and Brandon and Portage la Prairie, Man.

Maximum deliveries during 1957 are expected to be 67,000,000 cu. ft. daily. This volume will increase to 270,000,000 cu. ft. daily when such markets as Toronto and Montreal are reached.

The 1958 volume could be increased by 200,000,000 cu. ft. daily if the Federal Power Commission approves the importation of Canadian gas. The FPC is conducting hearings on a plan by Tennessee Gas Transmission Co. to distribute Trans-Canada gas in the Midwest through Midwestern Gas Transmission Co., an affiliate.

Construction delayed . . . Valve-turning ceremonies for cities on the western leg are a year behind schedule.

Trans-Canada got started after 5 years of planning, when the Canadian Government agreed in June 1956 to lend up to $80 million to finance 90 per cent of the cost of building the line to Winnipeg. Contracts were let immediately.

But work had hardly begun when the oft-delayed project received another setback. The steel strike in the United States delayed pipe deliveries, upsetting the plan for gas to be in Winnipeg by September 1956.

Only 230 miles was laid last summer and fall. Thirteen spreads have been working this year, however, with a schedule of 1,064 miles of pipe. Only the northern Ontario section will remain to be completed next year.

The $378-million system will have initial capacity of 300,000,000 cu. ft. daily. Ultimate capacity, when all projected compressor stations have been built, will be 750,000,000 cu. ft. daily. Trans-Canada expects deliveries to be 600,000,000 cu. ft. per day in the fifth full year of operation.

Gas for the western cities is coming from Bindloss field through Alberta Gas Trunk Line Co., Ltd. Fields in the Provost area also are being connected. Other Alberta fields will be tied into the gathering system during the next 3 years. No compressor stations will be built this year.

Trans-Canada's ownership is split five ways. T.G.T. owns 17 per cent; Canadian Gulf Oil Co., 17 per cent; Hudson's Bay Oil & Gas Co., Ltd., 17 per cent; Canadian Delhi Oil, Ltd., 24½ per cent; and the Western Pipelines Group, 24½ per cent.

This offshore rig, drilling in a record 118 ft. of water and 30 miles from shore, was evacuated when storm warnings went up.

Esther Forces Gulf Personnel Inland

MORGAN CITY.—A tropical storm whipped across the Gulf of Mexico last week, and offshore oil companies put into effect a costly mass evacuation plan.

By comparison with two earlier storms which hit offshore oil installations this summer, Esther was a mild-mannered lady. She brought 60-m.p.h. winds, 5-ft. tides, and 10-ft. waves in some areas.

When the storm moved into the coastal belt of offshore oil fields, practically every man had been evacuated from the more than 100 rigs in the gulf. By then it was apparent that tropical storm Esther would cause very little damage to coastal oil installations.

Except for the 8 in. of rain accompanying the storm, it might have been described as a dry run. It gave the vigilant offshore companies another rehearsal for their coordinated evacuation plan.

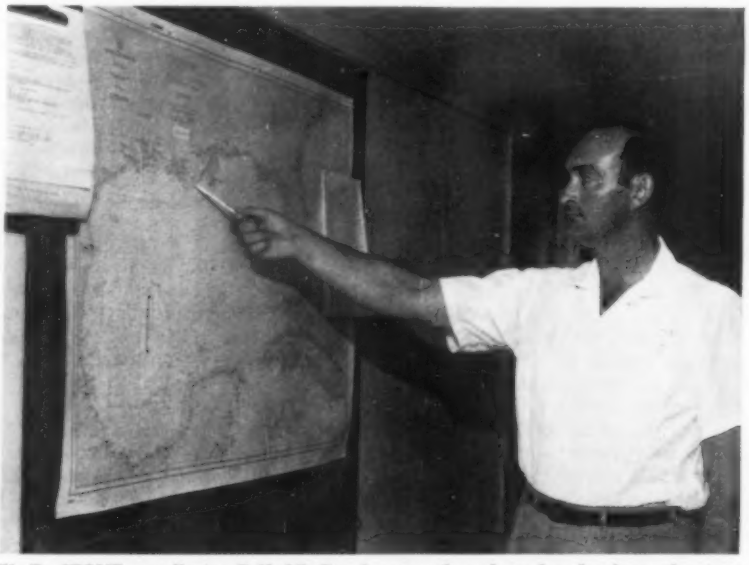
Costly anyway . . . Esther has gone on the records as a near-hurricane, a relatively mild disturbance which caused little physical damage. But, nevertheless, it was expensive. In down time and evacuation expenses alone, the storm cost the offshore oil industry an estimated $700,000 to $1,000,000.

At that, the cost will be cheap if it helps the companies prepare for the big blows which sometimes arise suddenly in the gulf and rush toward land. In such instances, coordinated evacuation plans can mean survival.

What Gulf did . . . Typical of the evacuation procedures developed during the oil industry's relatively short experience at sea is that of Gulf Oil Corp. Last week was the third time this year that Gulf had a chance to practice it.

When first notice of the storm reached Gulf's district office at Morgan City, Phase 1 of the evacuation plan started. This phase involves routine precautions and goes into effect whenever a storm is spotted anywhere if it is considered a potential menace to offshore oil operations.

During Phase 1, Gulf transportation officials check company tugs, crew boats, and helicopters to ascertain which may be available for evacuation. On platforms, tenders, and



V. D. STONE coordinates Gulf Oil Corp.'s evacuation plan when hurricane threatens.

barges, tools and equipment not scheduled to be used within the next 72 hours are secured in place or removed. Communications links with shore are checked. Rope, chains, and other equipment are made ready.

Phase 2 starts when the storm moves into or develops in the Gulf of Mexico. This calls for removal or securing of offshore equipment not needed for the next 32 hours. Fuel supplies of crew boats and other means of transportation are checked. Pumpers shut down producing wells and move to nearby platforms, ready for evacuation. Drilling wells are conditioned for shutdown.

When the storm is an estimated 48 hours away from oil installations, Phase 3 begins. Drill pipe comes out of the hole, blowout preventers are closed, evacuation boats move to the offshore installations, and evacuation of surplus personnel begins.

Phase 4 begins when the storm is about 24 hours away. Remaining crews, already on tenders, head for port unless captains decide to ride out the blow or seek refuge elsewhere.

After evacuation is completed, rosters are carefully checked, and information is passed through the Morgan City district office for relay to workers' families. Off-duty employes by then have mobilized company cars to evacuate families in danger areas on shore or to help in general relief work. If the storm is severe, the company offers its assistance to civil authorities wherever needed.

Phases of the evacuation program can be speeded up or overlapped if the storm sneaks in quickly.

Who runs it . . . Gulf's evacuation and relief plan is coordinated through a five-man hurricane committee headed by V. D. Stone, district drilling engineer at Morgan City (photo).

This committee, keeping in touch with the Weather Bureau and Gulf's own weather consultants, directs the over-all evacuation plan and keeps distant offshore workers informed.

Last week, Gulf evacuated all personnel from its five rigs off Louisiana.

One of the crews evacuated was working over the deepest water in which drilling has ever been conducted (photo). Drilling in 118 ft. of water was shut down at 13,760 ft. in the record-breaking test. The test is in Block 135, South Timbalier area, more than 30 miles offshore.

By noon of September 17, about 12 hours before the storm hit the oil area, all of Gulf's offshore rigs were shut down. Within 12 hours after Esther moved inland, crews were again climbing back on the platforms to resume drilling.

Processing briefs

Dow Chemical Co. is adding multi-million-dollar polyethylene plastics facilities at its petrochemicals plant now under construction at Bay City, Mich. The polyethylene plant is expected to go on stream in October 1958. It will take raw materials from the petrochemicals plant, where the chief product will be ethylene, and from Bay Refining Corp., a wholly owned subsidiary at Bay City.

Cities Service Refining Corp. has cut back runs at its Lake Charles, La., refinery by another 10,000 bbl. daily. Total reduction at the 185,-000-bbl. plant now totals 25,000 bbl. per day. The cutback began June 1 to help correct an imbalance in petroleum-product supplies.

American Oil Co.'s refinery at Yorktown returned to full operation last week—just 6 days after a fire in the pumping area forced a shutdown. A welder's torch is believed to have started the fire, which lasted 3½ hours and injured one operator. Partial operation resumed the same day.

Kerr-McGee Oil Industries, Inc., has purchased a crude unit at Tidewater Oil Co.'s shutdown Drumright, Okla., refinery. The unit will be moved to Kermac's Cushing, Okla., refinery and then modernized. Tidewater closed the refinery 18 months ago. Capacity of the Cushing refinery, now rated at 22,000 bbl. per day, will not necessarily be increased by the move because some of the older stills at Cushing may have to be replaced. The Drumright unit has a 16,000-bbl. capacity.

Standard Oil Co. (Ohio) has broken ground for a $3,800,000 alkylation unit at its No. 1 refinery at Cleveland. Completion is set for May 1, 1958. Feed stock will be butane gases from the refinery's catalytic cracker. The new unit will produce up to 3,570 bbl. a day of 100-plus-octane gasoline components.

Sohio Petroleum Co. is converting to asphalt and asphaltic products as the chief production items at its 17,-000-bbl. Latonia, Ky., refinery. Finished gasoline will be made at other Sohio refineries where capacities have been increased and more modern units are operating.

The move will reduce Sohio's work force at Latonia by about 75 persons. Reorganization of personnel will start immediately and will be completed by early November. The plant will be shut down November 3 for a 2-month cleanup, inspection, and training period.

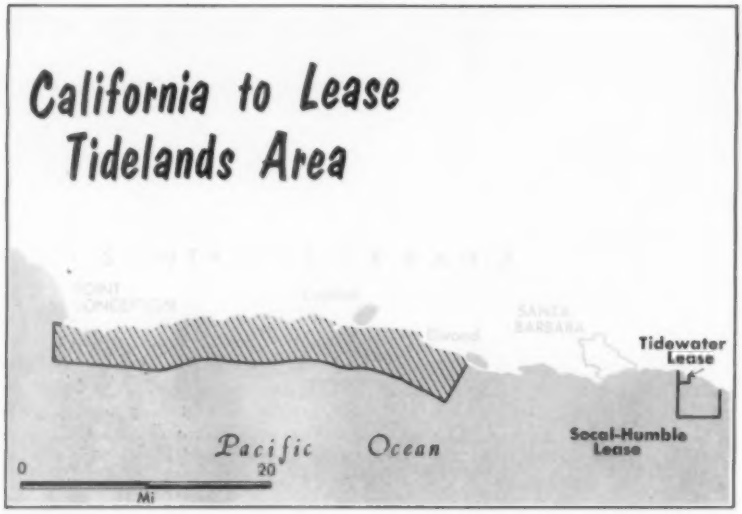
Sunland Refining Co. is on stream with a 1,000-bbl. U.O.P. Platforming unit at its 4,500-bbl. refinery in Bakersfield, Calif. The unit is producing 98-octane motor fuel. Feed stock is a 170°-384° F. naphtha derived from California crude.

Continental Oil Co. has completed its new $320,000 products terminal 2 miles southwest of Grapevine, near Fort Worth. The terminal is on the eastern end of Continental Pipe Line Co.'s 6-in. line which moves products from Conoco's Wichita Falls refinery. It includes storage tanks for 2,100,-000 gal. of products.

Also for Refiners . . .

IN THE NEWS: Importing refiners indicate they'll have December imports down 174,000 bbl. daily from August. But that's still 52,600 bbl. above quotas (p. 65) . . . General Petroleum has spent $500,000 at Torrance refinery to eliminate a steam cloud, although it wasn't contributing to air pollution (p. 67) . . . Total products demand may not increase next year but is expected to move up again after that, two industry experts predict (p. 71) . . . Texas production cut to a 12-day schedule for October, lowest in state's history (p. 71) . . . Texaco workers at Bayonne are enthusiastic about a new home-care hospital plan (p. 72) . . . Independent refiner protests military buying plan in Caribbean (p. 78) . . . Conoco moves into atomic research with new Ponca City lab (p. 82) . . . Sun Oil and Humble also show off new research labs (p. 83) . . . Amoco Chemicals shuts down Brownsville plant, ends effort to produce fuels from air, natural gas (p. 84) . . . Filipino interests trying to round up capital for new refinery (p. 87) . . . Socal finally getting a site for a new refinery in Hawaii (p. 89) . . . English projects will boost refining capacity in United Kingdom by one-third (p. 89).

PLUS THESE TECHNICAL REPORTS: What isotopes are doing for refiners (p. 91) . . . Dehydrating natural gas with glycol (p. 106) . . . Report on General Petroleum's Sovaformer (p. 112) . . . The Foreman's Page (p. 129) . . . and Questions on Technology (p. 133).



California Revises Leasing

● State Lands Commission will take bids on 54,000 acres, but big question is: What royalty rates will be charged?

LOS ANGELES. — California is finally untangling itself offshore.

After more than 2 years of virtual inactivity on tidelands leasing, the state is getting ready to offer 54,000 acres off Santa Barbara County between Point Conception and Elwood.

And, armed with a new set of leasing laws which went into effect this month, it appears to be in a hurry to move off dead center. The State Lands Commission won't wait, as it has in the past, for companies to request specific acreage. It will simply hold its hearings and then call for bids.

The state isn't moving at such a fast pace, however, when it comes to answering the big question of how much it will cost in royalty payments to land the upcoming concessions. That won't be known for at least 2 months, the length of time it will take to break up the area into parcels and establish a basis for bidding.

Some commission staff members strongly favor keeping rates low enough to encourage fast development of the tidelands. Just what rates they think will fill that bill, however, isn't known.

Two Tulsa consultants, Dr. Herman Kaveler and a consultant from the firm of Keplinger & Wanenmacher, will be brought in to assist in setting up the new royalty-rate policies, according to Frank J. Hortig, land-commission executive officer.

Hortig said out-of-state consultants were selected "to minimize any possible problem of local bias" and because both consultants have had considerable experience in gulf offshore leasing.

Costs going up . . . Regardless of what the commission members work out among themselves, the royalty rates are going to be higher than they have been in the past, at least for wildcat acreage.

That much has been decided already by the only fixed restriction in the Allen Miller bill, which has set the rules for new leasing. The restriction places the lowest royalty rate that can be charged at 16⅔ per cent. The rate can be scaled up from there.

Under the old rules, wildcat acreage went for a flat 12½ per cent. The rate on proved acreage started at 16⅔ per cent and went up from there. The Miller bill throws out the requirement for classifying lands as wildcat or proven. The bill also gives the commission the authority to ask for bids, with or without a cash bonus:

. . . On a fixed royalty basis.

. . . On a highest royalty-bid basis.

. . . Using any other combination of fixed or sliding-scale royalty bonus.

Among other changes provided by the new bill is the size of parcels. They can't be any bigger than 5,760 acres. There is no minimum size, however.

Familiar ground . . . The 54,000 acres now up for consideration is well known to oil companies.

Before leasing was stopped last spring, when it became obvious royalty rates were going up, Standard Oil Co. of California and the C.U.S.S. Group (Continental, Union, Shell, and Superior) had asked that the acreage be put up for lease.

Their requests had been processed to the point where the state was ready to advertise for bids on five 5,000-acre-plus parcels within the 54,000-acre block (OGJ, Feb. 4, p. 78). Then the legislature ordered leasing halted. The big requests were tossed out and the five parcels taken off the block. Neither Socal nor the C.U.S.S. Group applied again.

California has been tangled up offshore by regulations, red tape, and near-constant bickering since the first tidelands law was passed more than 2 years ago, with things moving at a snail's pace all the while.

Only two leases were awarded in that time. One was a 500-acre block which went to Tidewater Oil Co. for a bonus bid of $75,000. The other was a 5,500-acre block picked up by Socal and Humble Oil & Refining Co. for a bonus bid of $7,250,000. Both leases are off Summerland in Santa Barbara County.

Socal recently announced plans to build the state's first development drilling platform to test the lease it holds jointly with Humble. The decision followed a core-drilling program on the lease.

Tidewater slant-drilled a dry hole from onshore on its lease and was granted permission to postpone further drilling until February 11, 1958.

Rangely Flaring to Drop

RANGELY, Colo.—Flaring in Colorado's Rangely field will be cut in half when unitization becomes effective October 1. The big field is currently flaring about 45,000,000 cu. ft. of gas daily.

In addition, field interests say that within 2 or 3 weeks after unitized operation begins, up to 35,000,000 cu. ft. of dry gas will be pumped back into the producing Weber reservoir through injection wells working at full capacity. Equipment in the field is now being relocated and expanded to begin the conservation program.

The Colorado Oil and Gas Conservation Commission will hold a hearing September 24 to consider a general plan of operation submitted by The California Co., unit operator. A commission spokesman said a water flood scheduled for the field probably will not be started until around January 1.

Daily average production of about 70,000 bbl. is expected to be continued at that level.

HORTON® STRUCTURES

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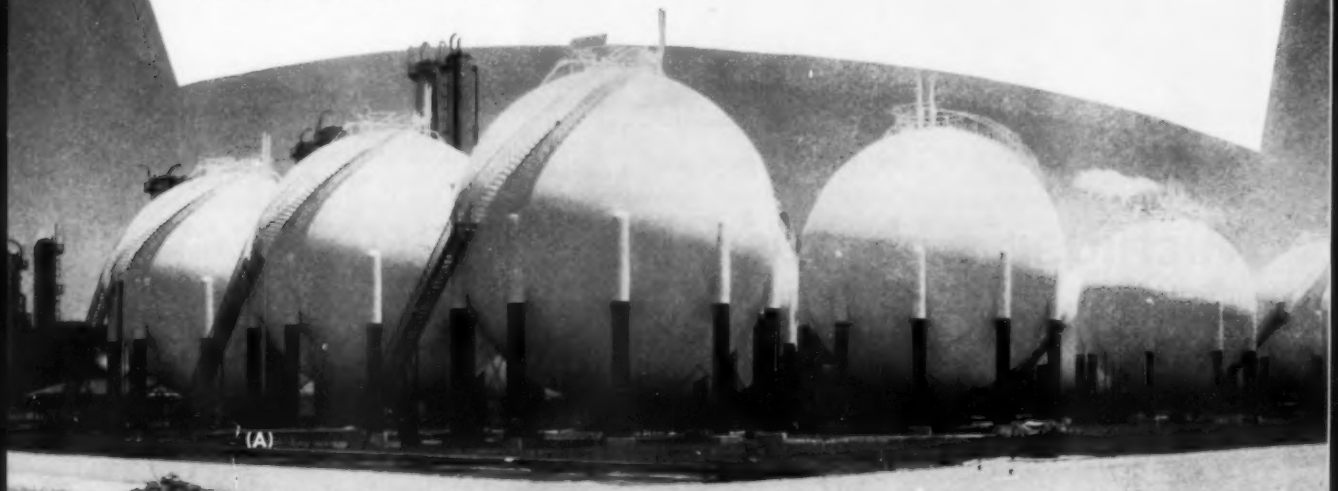
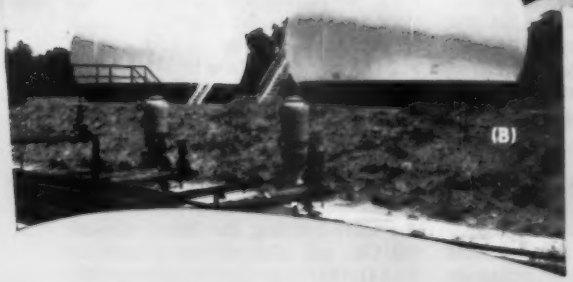


Where There's Refining There's CB&I



(A) 19 Hortonspheres range in capacity from 2,500 to 12,000 barrels and in pressures from 60 to 130 pounds.

(B) Two Hortonspheroids® storing 5,000 barrels each—are designed for 15 pounds per square inch working pressure.

(C) Horton Double-Deck Floating Roof tanks store aviation gasoline.

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This well blows wild from Trenton pay, and . . .

Michigan's Hopes Rise

A DEVELOPMENT WELL that flowed wild for 25 hours is giving Michigan new hope for heavy production in the deeper pay zones of the historic Trenton formation.

The Trenton, which dates back to the 1880's as a producer, has now paid off in southern Michigan's Scipio field with a spectacular blowout. The well is the fourth, and best, in the field.

Operators estimated production at 200 bbl. of oil per hour and 10,000,000 cu. ft. of gas per day.

The well is the best found from the Trenton since 1954 and should touch off new exploration activity. When Trenton production was found in Northville pool near Detroit 3 years ago, it resulted in a reappraisal of southeastern Michigan's potentialities as an important producing area of the Great Lakes province (OGJ, July 4, 1955, pp. 155-58).

The only other Trenton oil in Michigan outside Scipio and Northville is Deerfield pool in Monroe County. The pool was opened in 1920, but there is no production today.

Formation widespread . . . The industry long has known the possibilities of the Trenton—but more for gas than oil. The Trenton has been a producer across Indiana and Ohio, into Kentucky and Virginia, and north to New York and Ontario. Back in 1888, New York's shallow Clyde field near the eastern end of Lake Ontario produced gas from the Trenton.

Much of Michigan's oil future may lie in the deeper pay of the Trenton—and operators are hoping development of Scipio field is the long-sought sign of new wealth from their old friend.

The blowout well is the 1 Stevens (SE SW NE 10-5s-3w, Hillsdale County) of Aurora Gasoline Co. and McClure Oil Co. Hillsdale County borders on Ohio and is near the northeast corner of Indiana.

The well is an inside location between two previously developed Trenton lime wells and another opened late last year. The Trenton was logged by the new well at 3,540 ft. The blowout occurred at 3,767½ ft. when circulation was lost. The same section had shown some gas in other field wells, but the best pay was deeper.

Surface break . . . An effort to shut in the wild well with the blowout preventer was made shortly after the blowout occurred, but this was abandoned when gas and oil broke through as far as 200 yd. from the rig.

Operators believed the escape was through a shale fracture at approximately 250 ft. and feared cratering and loss of the rig. The rig was built on a triple plank foundation in a 60-ft. thick bog marsh, and there was only 206 ft. of 8-in. cemented casing in the hole at the time.

After 25 hours, the well was killed by injecting a 10-lb. salt solution. Twelve minutes of pumping at pressures of 300 psi. down to 110 psi. did the job. Continuous pumping of fresh water and light mud kept the well quiet for 3 days.

Operators then pulled the drill pipe and ran 3,756 ft. of 5-in. casing and cemented.

Foreign Fuel Buying Opposed

WASHINGTON.—The U. S. military will buy more than 8 million barrels of jet fuel in the Caribbean in the next 6 months, and the decision is stirring up opposition in the domestic refining industry.

One refining spokesman said the purchase puts government agencies at cross purposes in the program to control petroleum imports (see related storp p. 65).

The Military Petroleum Supply Agency denies there is any conflict.

Rear Admiral O. P. Lattu, MPSA's executive director, said the contracts were let to the Caribbean refineries in line with previous practices which require the military to grant awards to the lowest responsible bidders.

Said Lattu: "Before making the awards, consideration was given to the recommendations of the President's special committee to investigate crude-oil imports to make sure that the proposed awards were consistent therewith."

Lattu said the committee recommended limitations on crude imports only and there was no need, at this time, to limit imports of finished petroleum products.

What was awarded . . . The MPSA's purchase for the next 6 months totaled 36 million barrels of jet fuel costing $128.6 million. Contracts were signed with 57 refineries, of which 3 were outside the United States. The 3 got contracts totaling $28.3 million.

Esso Export Corp. won the big share of the foreign business—252 million gallons for $20,764,800. Gulf Oil Corp., acting for Mene Grande Oil Co., got 38.2 million gallons for $3,141,684; and Shell Caribbean Petroleum Corp. got 52.6 million gallons for $4,425,956. The three firms will produce the jet fuel from Venezuela crude in Caribbean refineries.

The reaction . . . Richard B. Kahle, president of Eastern States Petroleum & Chemical Corp., hurled sharp criticism at the contracts during a hearing in Washington on Eastern States' request for a higher import quota.

The purchase, he said, means "40,000 bbl. per day of the light ends

from crude oil, the heavy ends of which can be imported into the United States as fuel oil without restriction."

"This means a loss to the domestic producers and refiners of markets for about 150,000 bbl. per day of crude oil, or roughly one-half of the reduction in imports which the Office of Defense Mobilization has stated was essential from a national defense point of view."

Kahle said that while the price for the Caribbean product is 12 per cent under the gulf price, the contractors pay no duty on its import or income or other taxes on the business.

Then he argued: "If price alone is the determining factor in such purchases, it must be obvious that the importations of oil have no relation to the matter of national defense."

But, he added, if national defense actually is jeopardized by importing of crude oil, "it would seem wrong for the Defense Department to buy products, and the Office of Defense Mobilization to allow the importation of the residue, when such production amounts to one-half of the amount which the ODM thinks is a threat to national defense."

Big Year for Gas

$616 million in projects approved in fiscal year '57

WASHINGTON. — The Federal Power Commission last week added up its gas regulation business for the past fiscal year. The books showed the FPC:

... **Approved** construction of natural-gas facilities costing $616 million and adding more than 2.25 billion cubic feet daily capacity to the nation's pipelines.

... **Allowed** pipeline company rate increases totaling $42.4 million per year.

... **Suspended** pipeline company rate increases totaling $95 million per year.

Biggest item of pipeline expansion is the Texas Eastern Transmission Corp.'s project to convert the "Little Big Inch" line from gas to products. The project, which makes possible gas imports from Mexico, will increase the company's capacity by 455 million cubic feet daily. Over-all cost is $138.5 million.

The FPC approved 174 projects—more than in any previous year. These consisted of 7,878 miles of line, 350,000 compressor horsepower. While well above fiscal 1956, the figures are sharply below the all-time record of 1951.

Pipeline briefs

Transwestern Pipeline Co., recently organized to build a gas line from the Four Corners area to California, will open an office in Dallas. Robert W. Chan, who retired last month as first vice president of Magnolia Petroleum Co., will head the Dallas office. Chan has been elected a director of Transwestern.

The new company was organized by Warren Petroleum Corp., Monterey Oil Co., and J. B. Butler, Houston consulting engineer (OGJ, July 8, p. 75). The company plans to build a 200,000 M.c.f. line to the Los Angeles area. John R. McMillan, executive vice president of Monterey, is president of Transwestern.

Service Pipe Line Co. has let contracts for two short loops on its crude pipeline to Chicago. O. R. Burden Construction Corp. will start later this month on 4.2 miles of 12-in. paralleling Service's 10-in. line between Dyer and Griffith, Ind. When this job is finished crews will move in on 7.5 miles of 24-in. in Will County, Illinois. This loop parallels 12 and 18-in. lines.

Butte Pipe Line Corp. will increase capacity of its 16-in., 315-mile crude line from Baker, Mont., to Fort Laramie, Wyo., from 49,000 to 65,000 bbl. daily by adding two booster pumps at Baker. Storage at Baker also will be increased 40,000 bbl. to 180,000 bbl.

Shell Oil Co. is majority owner of Butte, with 60 per cent interest. Shell Pipe Line Corp. operates the line, which connects with other lines at Fort Laramie and Guernsey, Wyo., for movement of crude into the Mid-Continent area.

Ohio Fuel Gas Co. of Columbus has been granted temporary authority by the FPC to build 33 miles of pipeline in 11 counties of Ohio. The lines, varying in size from 4 to 20 in., will replace existing lines in Lorain, Belmont, Guernsey, Champaign, Logan, Greene, Clark, Madison, Fayette, Licking, and Richland counties. Cost of the new line is estimated at about $1,241,500.

Toronto Pipe Line Co. has started construction of a 20-mile, 4-in. crude gathering line to production in the Munday area of Knox County, Texas. The line will carry production to a connection near Seymour, Baylor County, North Texas, of a Shell Pipe Line Co. 10-in. line. The new gathering line will have a capacity of about 2,000 bbl. daily.

The FPC has updated its map, "Major Natural Gas Pipelines," to show all existing lines and those under construction and proposed as of June 30, 1957. Systems of 126 companies are represented. The map, 13 by 18 in., also shows natural-gas fields, indicating both major sources and general areas of supply.

El Paso Natural Gas Co. has let construction contract for a $200,000 research laboratory adjacent to the Texas Western College campus at El Paso. Chemical and mechanical research for the company's pipeline system will be conducted in the laboratory. El Paso's 33-member research department will move into the 12,000-sq.-ft. building upon completion in 4 or 5 months.

Transcontinental Gas Pipe Line Corp.'s application to build 43.62 miles of 30 and 36-in. loop lines in seven eastern states has been given temporary approval by the FPC. The loops will be in Louisiana, Mississippi, Alabama, Georgia, South Carolina, North Carolina, and Virginia. They will raise Transco's total capacity from 877,000,000 cu. ft. daily to 921,700,000.

Also for Pipeliners . . .

IN THE NEWS: New offshore pipe-laying technique has been revealed by Brown & Root. A 350-ft. cradle guides pipe to sea floor, eliminating cracking at the joints (p. 70) . . . Gas will move this week from Alberta to Winnipeg through Trans-Canada pipeline (p. 73) . . . Natural-gas industry invested $616 million in new facilities during 1957, according to FPC figures (p. 79) . . . Texas independents have renewed fight on common-carrier pipelines (p. 80) . . . Pipe starts arriving for Texas-to-Florida gas line (p. 80) . . . Pipeline talk prominent in boiling Middle East oil picture (p. 86).

PLUS THESE TECHNICAL REPORTS: How to calculate pipeline flow efficiency (p. 114) . . . and Pipeline Patrol's report on the Four Corners crude line (p. 137).

Pipeline Fight Reopens

● Brief claims pipelines deliberately shun Texas wells in favor of imported oil, asks commission to invoke old statute to force common carriers to make new connections

AUSTIN.—Texas independent producers renewed their attack last week on common-carrier pipelines with a follow-up brief filed with the Texas Railroad Commission.

The brief, called for by the commission following hearings ending last May, charged that pipeline subsidiaries of major oil-importing firms have "subtly and skillfully" restricted West Texas production to make way for more imported oil.

The brief laid the responsibility at the door of the majors for the existence in Texas of about 8,400 unconnected oil wells. The majors, it said, have wilfully failed to enlarge pipeline capacity to take oil from these wells in order that they might fill new demand in this country with cheaper imported oil.

The producers alleged that the carriers have put a ceiling on West Texas production. They said there have been no substantial increases in West Texas pipeline capacity in recent years and that none are planned. With present capacity (as clarified during the Suez crisis), the pipelines in that area can handle only 18 days' production.

Thus, the lines, by this failure to expand facilities, have placed an artificial ceiling on West Texas production. This is because the Texas Railroad Commission, they say, cannot by law require production above the capacity of the state's transportation system.

The producer brief pointed out that the common carriers "in 1956 retained less than 1 per cent of their earnings for improvement and expansion as compared with 60 per cent in 1948."

It said further that the nine carrier subsidiaries of importing companies disbursed to the latter "excess earnings of $112,114,000 over and above a 6 per cent return on capital investments in the 3-year period 1954-56."

The brief urged the commission "to order all common carriers to extend their lines a sufficient distance to connect any well requesting connection, unless the carrier is released from such extension after notice and opportunity for hearing."

Carrier obligation . . . The producers contend that the common-carrier pipeline has an obligation by law to serve all producers who ask service and that it should not be permitted to deny service to any producer because that one connection might not make the carrier a profit; the carrier is guaranteed a fair return on its over-all investment.

The brief detailed in 40 pages specific cases of hardship in which producers were said to have lost production and suffered economic distress for lack of pipeline outlets.

The producers argued again, as they did at the hearings earlier this year, that the commission has the authority under present statutes to order the lines to expand capacity and to define distances that gathering systems should be extended.

They cite Article 6049A, Section 7, V.C.C., of the Texas statutes. This section gives the commission the power to order a common-carrier to extend or enlarge its system if:

. . . The extension or enlargement is "reasonable."

. . . It is in the public interest.

. . . It is not so expensive as to impair the carrier's duty to the public.

Another section of the same article orders the commission to inquire into each field to see if any common purchaser is discriminating against any producer by withholding a pipeline connection. If such discrimination exists, this section instructs the commission to order the carrier to make any reasonable extension of its lines to relieve the situation.

Smaller pipe arrives—big-inch on way as . . .

Big Push on Florida Line Near

ST. PETERSBURG, Fla.—First 24-in main-line pipe for the 2,600-mile gas-transmission system stretching from the Texas Gulf Coast to Florida will start arriving next month.

F. E. Stanley of Tulsa, president of the Houston Texas Gas & Oil Corp., says engineering and design work on the system is far advanced and field construction will get under way soon.

He made the statement in a progress report to B. R. Fuller, Jr., executive director of the Florida Development Commission, and Alan S. Boyd, chairman of the Florida Railroad and Public Utilities Commission.

The shipment of 24-in. pipe for the main line will come from Republic Steel Corp. rolling mills at Gadsden, Ala. The $6-million order represents about 150 miles of main-line pipe. Houston and its partner in the project, Coastal Transmission Corp., have placed orders totaling $63 million covering all major equipment and materials.

Coastal will build and operate the gathering lines from Gulf Coast fields in Texas and Louisiana and the main line to Baton Rouge, La. Houston will build and operate the main line from there to Florida plus laterals serving all Florida. Project completion is scheduled for late summer of 1958.

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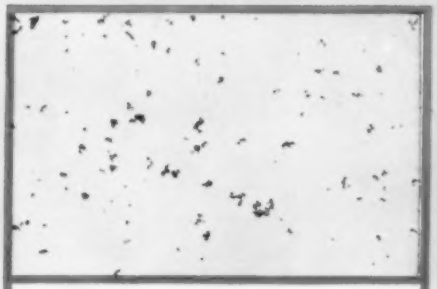

Above—Untreated fuel oil, after aging, (magnified 200X) showing typical sludge formation.

Below—Nalco treated... same fuel oil... same aging, showing sludge prevention.

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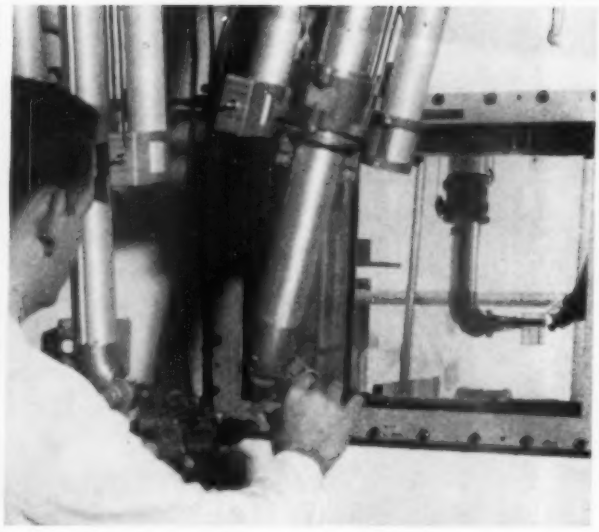


Uranium arrives in a 13-ton casket . . . . . . and is handled by slave hands in the lab.

Conoco Moves Into Atomic Research

PONCA CITY, Okla.—Continental Oil Co. has taken a big step into the future with completion of an atomic-radiation laboratory here.

One of the first labs in the country to use fuel elements as a source of atomic radiation, the new research facilities were built at a cost of about $500,000.

E. R. Baker, manager of development and research for Continental Oil, said nuclear radiation will be used in laboratory experiments designed to create or improve petroleum and petrochemical products and processes.

First radiation fuel elements, now in use at the new lab, consisted of four 10-lb. uranium rods. Encased in a protective 13-ton lead casket, the rods were supplied from the Atomic Energy Commission's plant and atomic reactors at Arco, Idaho.

Baker said the 10-lb. rods are expected to last about 4 to 6 months. By then they will have lost about three-fourths of the energy they had upon arrival at the lab. Replacements will be shipped in as needed from atomic reactors at Arco.

Super safety . . . The gamma ray is the principal radiation from the uranium rods being used at the Conoco research center.

Gamma radiation research is conducted in a small "hot cell" (OGJ, Sept. 24, 1956, p. 94). The cell is shielded by a wall of specially prepared concrete 5½ ft. thick with two radiation-resistant windows, each 4½ ft. thick.

Radioactive rods are elevated by remote control to the hot cell. When not in use, they are stored at the bottom of an 18-ft. well beneath the hot cell. The well contains 19,500 gal. of demineralized water, which is purified constantly by recirculation. Underwater experiments also are possible.

"Scientists in the operations room just outside the hot cell manipulate equipment in the cell area remotely by using long, robot-like mechanical hands mounted in the walls," the company said.

"Working as a team, the hands outside the cell can direct the hands inside the cell in such detailed work as tightening a bolt, penciling identification on a glass, or exchanging chemical solutions from test tube to test tube."

The lab is equipped with a closed-circuit television camera. This permits scientists to view operations in the cell from a monitor in the operations room. A powerful periscope mounted in the cell wall also gives a closeup view of operations anywhere in the hot cell.

The new laboratory is adjacent to Conoco's research "roundhouse" here.

"It is so designed and equipped safety-wise," said Baker, "that a scientist working in the area will be exposed to less gamma radiation in 2 years than a person gets in one average dental X-ray. A 1-minute X-ray fluoroscope examination is equivalent to more than 10 years of exposure in the unit's operating area outside the hot cell."

New fields opened . . . In addition to gamma radiation research, the new lab will house radiotracer studies which previously were impossible at the Conoco research center.

"By tagging an atom—making it radioactive—we can trace the flow of liquids through pipes or oil formations," Baker explained. "We can learn more about how greases and oils lubricate, how oil is recovered in a producing oil field, or how wear and corrosion occur in engines and oilfield equipment of all types.

"Radiotracing will open the door to countless new studies of the reactions of hydrogen and carbon, the principal elements in petroleum."

D. A. Shock, director of the company's central research division, and John D. Sudbury, head of the division's special research section, are supervising operations at the new unit. Gamma-radiation studies are under direction of Dr. P. J. Manno, inorganic and physical chemist. Preston L. Gant, chemist, is directing the lab's radiochemistry or radiotracer group.

Other staff members include Dr. Kang Yang, physical chemist; Dr. O. D. Steffey, biologist and health physicist; and W. H. Snavely and J. K. Garland, chemists.

Other labs in the news . . .

Sun Oil Co. will expand its research into refining processes and marketing with the completion of a four-story research building at its Marcus Hook refinery. Sun will dedicate the new structure October 15 as a highlight of the company's observance of Oil Progress Week. The new building will house all manufacturing and marketing facilities formerly located at Norwood, Pa.

Individual laboratories occupy about half of the new building. It includes 39 single and 24 double labs. It also includes an electronic-computer center, a photo lab, and a glass-blowing shop along with a large research library. Sun's automotive lab, pilot-plant facilities, and gas-analysis lab also are located at Marcus Hook.

The new research building is near the main entrance of the refinery. The building is 346 ft. long, 48 ft. wide, and 45 ft. high.

Humble Oil & Refining Co. has increased the lab space at its Baytown, Tex., research center by about 70 per cent with the recent opening of a four-story building at the center. The new building will be used by Humble's refining research and development division. The addition provides an additional 27,000 sq. ft. of floor space.

—— *Industry* briefs

Humble Oil & Refining Co. and Shell Oil Co. will spud their joint-venture Alaskan wildcat late this month.

It will be the Bear Creek No. 1, a 12,000-ft. test on the Alaskan peninsula 350 miles southwest of Anchorage. Location is 5 miles north of Island Bay in the Kanatak area.

The two companies entered an agreement earlier this year (OGJ, April 29, p. 110) for joint exploration and production operations in the Kanatak area. Outside this area the two companies will operate individually.

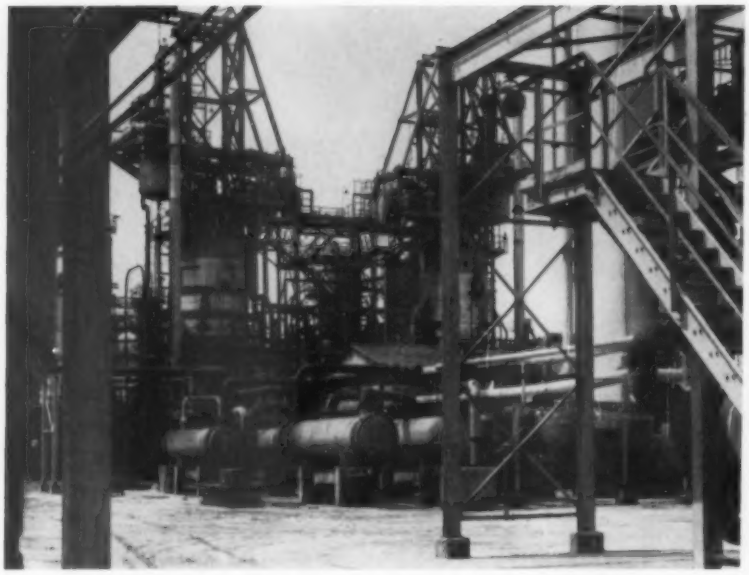
For Humble the venture is its first outside the United States and the immediate offshore area.

McRae Oil & Gas Corp. has acquired the assets of C. L. Pardo Oil & Gas, Inc., for 175,000 shares of McRae common stock. Pardo's principal holding was an estimated 600,000 bbl. of proved primary reserves, mostly in Old Ocean field on the Texas Gulf Coast.

The 1956 edition of "Statistics of Natural Gas Companies" is available from the FPC. The publication contains detailed financial and operating information on 107 companies, based on annual reports filed with the FPC. Composite financial and operating statements summarizing this information are shown for the years 1946 through 1956.

Phillips Petroleum Co. has contracted to sell uranium concentrates to the Atomic Energy Commission. Phillips will construct and operate a uranium processing mill in McKinley County, N. M., with capacity of about 1,725 tons of uranium ore per day. Phillips owns major uranium ore deposits in the Ambrosia Lake area.

Leaders of the petroleum and transportation industries in Texas joined last week in Dallas with a testimonial dinner honoring Olin Culberson, chairman of the Texas Railroad Commission. Culberson is finishing his sixteenth year on the commission. He plans to run for reelection. Oil-industry speakers paying tribute at the dinner included J. J. O'Brien, president of the Texas Independent Producers and Royalty Owners Association; Sam Gladney, general manager of Sun Oil Co.'s southwest division; and W. J. Lawson, secretary of the Liquefied Petroleum Gas Association.



Huge synthesis plant will be abandoned as . . .

Amoco Ends Effort to Produce Fuels from Natural Gas, Air

BROWNSVILLE, Tex.—The operation was a success, but the patient died.

That's the story of one of oil's most interesting, and expensive near-misses—the idea of making gasoline from air and natural gas.

The patient was Amoco Chemicals Corp.'s gas-synthesis project at Brownsville.

The causes of death were several. But they boil down to this: While Amoco was whipping the technical problems, the economics of the project changed. By the time the plant was producing fuels in commercial quantities it was no longer profitable to do so.

The project includes the world's only gas-synthesis plant, a chemical separation plant, and a big storage terminal. Their combined object: Process air and natural gas to gasoline and other oil products plus a large quantity of byproduct chemicals.

The gas-synthesis plant, heart of the complex, went on stream in 1950. It was able, after several years and a number of modifications, to turn out products in adequate quantities.

But by this time the project consumed nearly $100,000,000 from 10 companies. Last week Amoco announced it is snapping shut its pocketbook and pulling out. It will start cutting its 800-man working force October 1, wind up the project "within the next several months."

A success . . . As Amoco put it, the project was a "technical success, but an economic disappointment." The company was not saying how much gasoline it was able to make at the plant, but it did say the amount was commercial—providing cost had been in better balance with price.

What it did was to break oxygen out of air and mix it with natural gas in a synthesis-gas generator under high temperatures and pressures to get a partial oxidation.

The charge stock thus produced was passed through a fluidized iron catalyst bed in the reactors to produce the equivalent of a light crude, plus water and oxygenated compounds in water solution.

Before the end came, Amoco had whipped most of the technical problems which had plagued the plant for so long and had proved without doubt that the process could be accomplished. One of the most troublesome steps, partial oxidation, is now being used at ammonia plants with success.

A failure . . . So why are the doors closing on such a costly experiment just when everything seemed to be smoothing out? For one thing, the plant was a curious paradox. It came too late, and it was years ahead of its time.

It was ahead of its time because the processes it used had to be worked out from scratch, over a long and costly pull. And the real culprit, reportedly the iron catalyst, was never completely whipped. It was too late because, by the time the processes were worked out, costs and market conditions had changed.

At the time the plant was conceived, petrochemicals were new, their prices high. Then competition set in and prices went down. At the same time, costs were going up—for equipment, labor, and materials. And the problems had been tougher and they died slower than had been anticipated.

How it started . . . In 1945 nine companies joined to form Carthage Hydrocol, Inc. They were The Texas Co.; The Chicago Corp.; Forest Oil Corp.; Hydrocarbon Research; La Gloria Corp.; Niagara Share Corp.; Stone & Webster, Inc.; United Gas Corp.; and Western Natural Gas Co.

The plant, costing about $50,000,000, was to produce 6,000 bbl. of gasoline, 900 bbl. of gas oil, and 200 bbl. of fuel oil daily from 90,000,000 cu. ft. of natural gas and 280,000,000 cu. ft. of air.

In the meantime, Stanolind Oil & Gas Co., now Pan American Petroleum Corp., built a $15,000,000 chemical plant to utilize the raw chemicals to be produced, and a storage and shipping terminal was built by U. S. Industrial Chemicals Co.

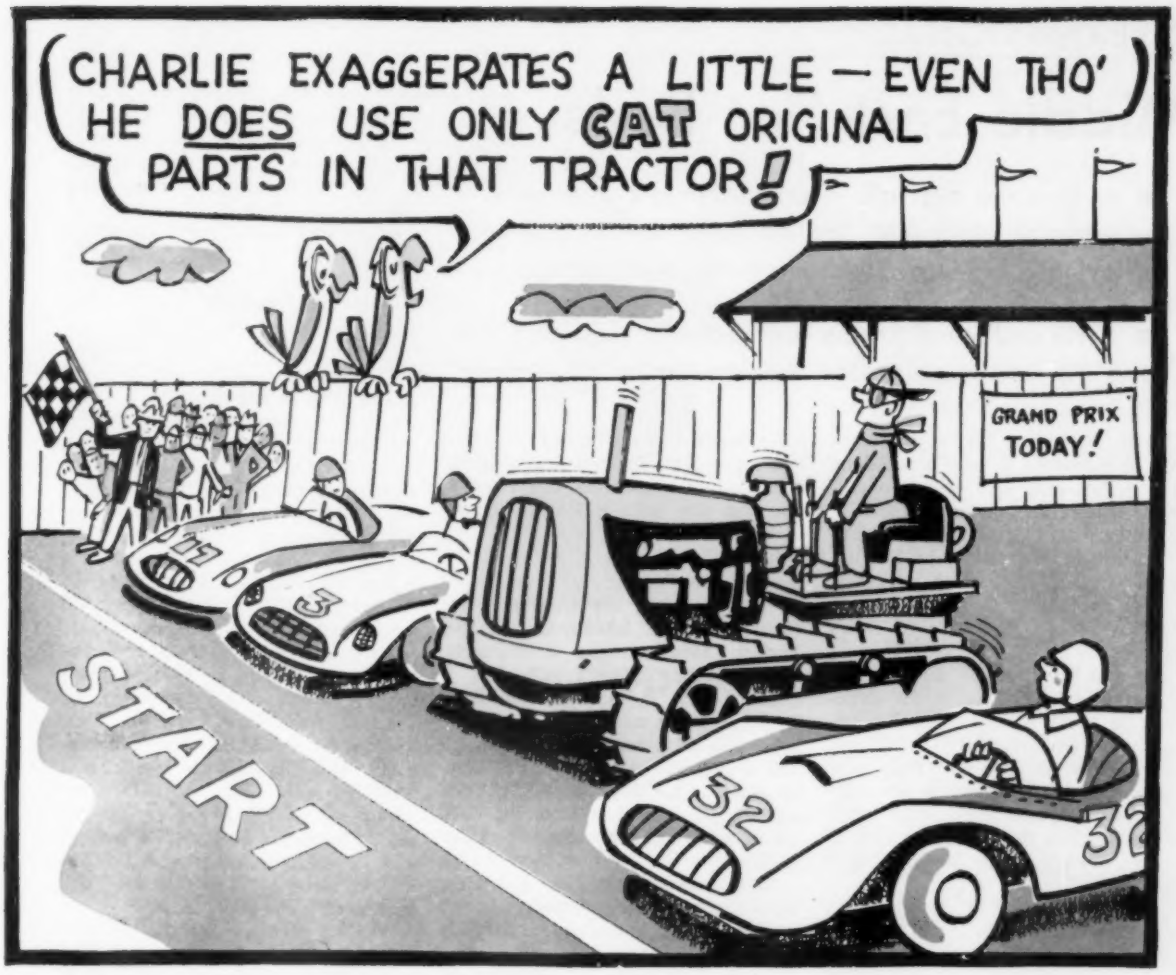
Carthage Hydrocol, however, was consistently plagued by shutdowns and never achieved more than 30 per cent efficiency. So the companies involved decided to write the project off as a loss and forget the whole thing.

This left Stanolind with a $15-million white elephant on its hands and faced with the problem of taking over the gas-synthesis plant or losing the money it had tied up in the project. Armed with a considerable amount of knowledge about gas-synthesis, gained from extensive experiments it had already carried out, the company decided to take a crack at salvaging the operations and making them pay off.

In April 1954, Stanolind picked up an RFC loan of about $17,000,000 the nine companies had left behind and started extensive revamping of the gas-synthesis facilities.

It also bought out the storage terminal and consolidated the holdings under a newly formed subsidiary, Hidalgo Chemical Co., later Amoco Chemicals Corp.

Standard Oil Co. (Ind.), the parent company, said the shutdown will mean a loss of about $5 million in net 1957 earnings. But this will be offset by the fact that it can now sell the gas it was supplying to the plant for a higher price on new contracts. And it will get out from under operating losses at Brownsville.



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Middle East Pot Boils

- In Iran the big talk is about Jersey's interest in an exclusive concession and the government's chance of laying a big-inch crude line to the Mediterranean.
- Syria and Saudi Arabia are trading diplomatic blows over Tapline revenue and the integration of Aramco.

THE WORLD'S biggest oil company is interested in new concessions in Iran, but only as a private operator—not with an Iranian partner.

Standard Oil Co. (N. J.) already has a 7 per cent interest in the international consortium which operates Iran's southern oil fields. Jersey Standard would like more of Iran's territory on its own.

Howard Page, Jersey director and a man who was active in the settlement of Iran's oil nationalization crisis 3 years ago, returned to New York last week from Teheran. Page says Jersey is interested in getting new concessions under Iran's new oil law. But, he emphasized that Jersey expects to pay an outright bonus for anything it bids for.

Iran's new enabling oil legislation permits National Iranian Oil Co., the government company, to make three kinds of deals for new exploration acreage. N.I.O.C. can form either a majority or a minority partnership with foreign companies or individuals, or it can negotiate for an outright oil concession to be operated privately. Page made it clear that his company is interested in the latter.

The Jersey executive says Jersey is interested in an offshore Persian Gulf concession in the same general area as one obtained by Italy's government-owned Ente Nazional Idrocarburi in a partnership deal with N.I.O.C.

Page didn't specify which offshore region he has in mind. The Italian-Iranian company, SIRIP, actually has two offshore areas. One, a 2,162-sq. mile block, is all offshore at the head of the Persian Gulf. It is possible that title to this could be disputed by Kuwait. Ownership of the underwater lands beneath the Persian Gulf have never been established.

The other region is a 2,316-sq.-mile block divided between land areas and offshore on the Mekran coast of Iran, south of the consortium's concession.

Iran-Turkey pipeline . . . While Jersey and a dozen other companies look over Iran's prospects for new exploration, the Iranians themselves are blithely planning the Middle East's biggest pipeline.

Iranian Government sources disclosed plans for the 1,000-mile, 38-in. pipeline from the Qum area of Central Iran to Iskenderun on the Turkish Mediterranean coast early this month (OGJ, Sept. 9, p. 76).

Last week in Ankara, Ghassem Eschragi, Iran's communications minister, said all plans for the construction are now ready. What the Iranian minister did not disclose is where Iran will get the money to build the line, which will cost an estimated $600 million.

Like most Middle East countries, Iran depends almost entirely on its oil income as a source of national wealth. This income, at the present rate, wouldn't begin to pay for such a pipeline. Most of the oil money is being used for other things. In fact, Iran's total oil income since October 1954, when her fields went back on production, has been only about $300 million. This includes taxes paid by the consortium, Iran's cash payments for her oil share, and the value of the oil that she has taken in lieu of cash.

Iran's oil production the first 4 months of this year averaged 671,000 bbl. daily, easily the peak output of the last 3 years. The government's income from oil during that period amounted to only about $70 million.

Private pipeline plans . . . Since the political shift to the left in Syria, the 17-company plan for a major pipeline project in the Middle East has almost dropped from sight.

The companies, 14 of them American firms with Middle East interests, are still actively planning new pipelines to move another 1,000,000 bbl. of oil daily, but Syria has complicated things further. The most-talked route for such a line would be from Iraq north through Turkey and then west to the Mediterranean. This would completely bypass troubled Syria.

This scheme would probably ruffle already tender Arab feelings. There is a real doubt whether or not Iraq would agree to such a pipeline and chance a slap in the face to neighboring Syria.

Aramco has problem . . . Saudia Arabia sharpened the needle it reserves for use on Arabian American Oil Co. last week, but got a good healthy jab at the same time from her troublesome Arab neighbor, Syria.

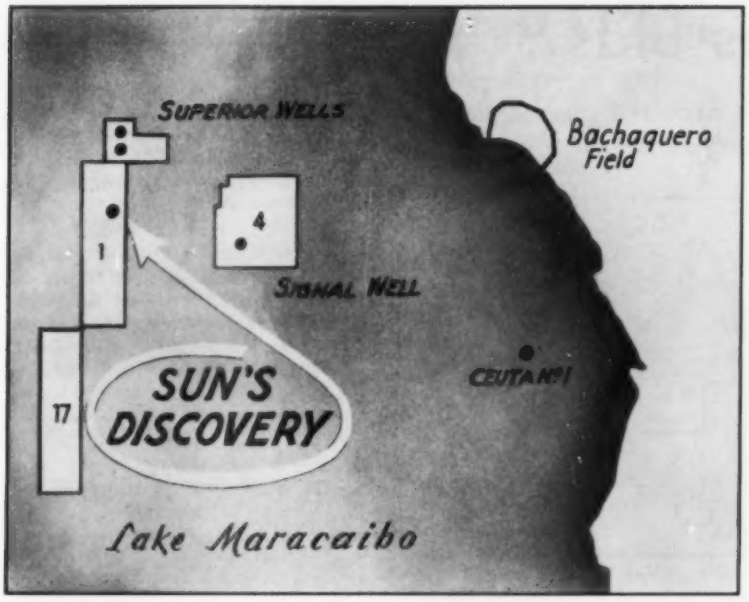
Abdullah Tariqi, Saudi Arabia's shrewd, Texas-educated oil administrator, claimed in Cairo that his country could triple its oil income if Aramco would go along. This is getting to be a familiar refrain with Tariqi. He wants a Saudi share in the profit from refining and marketing as well as the crude production.

At the same time, Syria protested that Saudi Arabia is being offered too big a cut from the profits of Trans Arabian Pipe Line Co. Tapline moves Saudi oil across Jordan, Syria, and Lebanon to the eastern Mediterranean. The Syrian protest was made at the Lebanese summer resort, Sofar. It's here that the Syrians and Lebanese are meeting with Tapline officials to work out a profit split among the four countries.

Tapline tried a year ago to settle repeated demands from the three transit countries—four counting Saudi Arabia—for more money for the privilege of crossing boundaries with oil. The company offered the four half of Tapline's profits and suggested they split the take among themselves. Under the formula Saudi Arabia, with much more of the pipeline within its borders, was to have 63 per cent. The other three countries would split the remaining 37 per cent. Syria howled to high heaven last week that this was too much for Saudi Arabia.

The Saudi oil boss, Tariqi, made his renewed pitch for Aramco to integrate during a visit to Egypt. His theory is that Saudi Arabia pays part of the costs of refining, transportation, and marketing of the oil without sharing in profits from anything except the production. He has urged in the past that Aramco do its own refining, transporting, and marketing.

Under present conditions, Aramco produces the oil and then sells the crude to marketing subsidiaries of its four parent companies, Standard Oil Co. of California, Standard Oil Co. (N. J.), The Texas Co., and Socony Mobil Oil Co.



Sun Strike Lifts Lake Hopes

THE BRIGHT outlook for central Lake Maracaibo was even brighter last week when word went out that Sun Oil Co. and its partners had drilled themselves a producer in Block 1.

The Sun group was as tight-lipped as ever about a series of tests under way on SVSX-1. But oil men in Venezuela are saying the well promises much better than earlier reports.

In a 2-hour test from 11,050 ft., the well reportedly flowed at the rate of 480 bbl. daily through a 3/8-in. choke. The crude was 36° gravity. The gas-oil ratio was 1,400. Tests are continuing.

SVSX-1 was the first test spudded by the group on its new lake acreage. Sun, the operator, holds 45 per cent interest. Atlantic Refining Co. has 45 per cent, and Seaboard Oil Co., 10 per cent.

The well helps keep hopes high for companies who paid out a total of $400,000,000 for lake concessions this year and last. It lies 6 miles south of the nearest of two flush Superior Oil Co. wells, Lama 1 and 5. The Superior wells got things on the new concessions off to a flying start when completed for a combined flow of more than 10,200 bbl. daily from separate Eocene pays (OGJ, Sept. 2, p. 83, and Sept. 16, p. 120).

Other wells . . . One other well is drilling in the central portion of the lake, and another is due to be spudded soon.

The Signal group will carry its wildcat in Block 4 to 13,000 ft. The well, second drilled in the block, drilled through more than 100 ft. of pay at about 9,800 ft.

The Phillips group is expected to start a well in Block 17 soon. This test will move exploration further into the lake than any well ever drilled. It will be drilled from a Kerr-McGee barge, which recently arrived in Maracaibo.

Ceuta line laid . . . In the eastern portion of the lake, Mene Grande Oil Co. (Gulf) has completed a 16-in. crude pipeline from its Bachaquero terminal on the east shore of the lake to the Ceuta area in the lake.

The 24-mile line, with more than 7 miles underwater in the lake, cost about $5½ million. The new line has a capacity of 150,000 bbl. daily. The company has added another 478,000 bbl. of storage at its Bachaquero terminal to serve the new line.

Meneg had already started drilling Ceuta 1 last year when the Venezuelan Government offered new Lake Maracaibo concessions. The well blew out last November and caught fire. The company has never revealed any details of the well, but reports indicate it flowed anywhere from 7,000 to 10,000 bbl. daily. The well has about 400 ft. of Miocene and 200 ft. of Eocene pay.

Since that time, Meneg has completed two more producers in the area and has two rigs running there now. The discovery was made on "old" Meneg acreage offshore from the eastern lake bank, but the company promptly bid in another 20,682 acres of national reserve acreage offsetting the well for an average of $1,380 an acre.

Plant Plans Clash

But Stanvac going ahead despite Filipino protests

A PROPOSAL for a refinery financed largely by Filipino capital is not likely to hamper the efforts of Standard Vacuum Oil Co. to build a 20,000 to 25,000-bbl. refinery in the Philippine Islands.

Reports from Manila say local citizens have asked the government to shelve all foreign refining proposals in favor of one backed at least 60 per cent by local capital. Philippine Investment Management Consultants, Inc., asked the National Economic Council to defer any approval of future refining plants in the islands.

The group plans to offer the Philippine Government a refinery to be built largely by local capital. They want the government to defer approval of a foreign financing scheme until their proposal has been received.

Spokesmen for Stanvac said the action of the Filipino group will have no effect on its plans to build a refinery in the islands. Stanvac for months has been seeking government approval of plans to build a refinery at Bataan on the west-central coast of Luzon.

The only refinery in the islands is the Batanga plant built several years ago by Caltex (Philippine), Inc., on Luzon's southwest coast. The Caltex refinery has a daily throughput of 13,000 bbl.

Creole Blowout Kills Self

CREOLE PETROLEUM CORP., can boast of the most considerate blowouts in Venezuela.

Creole's B-260B, which blew out, caught fire, and toppled its derrick 6½ miles southwest of Bachaquero field in Lake Maracaibo, killed itself early this month. It was the second blowout at the same location to go wild and then sand up, shutting itself off (OGJ, Sept. 9, p. 79).

The first was B-260A, which went wild in June while the company was trying to make a well at the location of B-260, which they had to abandon with fish in the hole in October 1954.

Bolivia Studies Bids

Decision on big concession is expected at any time; 17 firms submitted bids, but only 4 still have a chance

BOLIVIA WAS PREPARING late last week to pick the winner of a 108,000-acre concession in the Yacuiba-Madrejones area in the southeastern part of the country.

Companies still in the running were reportedly boiled down to four of these six bidders:

... Bolivian Gulf Oil Co., which already holds 3,750,000 acres in Bolivia and is getting ready to spud its first test.

... Cie. Financiere Belge des Petroles S.A. (Belgian Petrofina), the international Belgian company.

... Argos, Ltd., representing Fish Engineering, North American Utility & Construction Co., Petroleum Machinery & Service Co., and TIPSA, the American-European combine which recently won a $115-million contract for pipelines and other facilities in Argentina. Fish and North American Utility are also participating in TIPSA.

... J. Christensen Financial Corp., an Argentine firm with offices in New York.

... G. Madlener y Asociados, a Buenos Aires firm representing Hydrocarbons Corp., Savoy Oil Co., and Wedel Phillips.

... Oil & Gas Property Management of New York.

The area involved is just north of the Argentine border and adjacent to the old Glenn McCarthy concession, recently taken over by T.U.L.M. Corp. of Houston (Tennessee Gas Transmission Co., Union Oil & Gas Corp. of Louisiana, Lion Oil Division of Monsanto Chemical Co., and Murphy Corp.).

Oil reportedly has been found on the Argentine side of the Yacuiba anticline, and McCarthy found both oil and gas at his nearby concession.

A Bolivian spokesman told the Journal that 17 bids were received, but that only six of them met all the specifications set out in the bid invitations. The list was further narrowed to four by recommendation of Yacimientos Petroliferos Fiscales Bolivianos, the government oil agency. Y.P.F.B. did not identify which four are still in the running.

The spokesman said these four were being considered by the president's cabinet and a congressional committee, with a decision expected any time. Any further action necessary to make the selection final, he said, would be merely a formality.

The proposals . . . Bolivian Gulf has offered an 11 per cent royalty plus a tax of 19 per cent, or a total of 30 per cent of gross production. When estimated recoverable reserves reach 50,000,000 bbl., Gulf will pay an additional tax of .005 cent per barrel. This also goes for gas.

During the first 10 days following the signing of the contract, Bolivian Gulf is to make $5 million available to Y.P.F.B. without interest. In addition, Bolivian Gulf would donate to Y.P.F.B. 16,000 tons, about 193 miles, of line pipe delivered free of charge at the Chilean port of Arica.

Petrofina proposes a contract similar to the one it has with Mexico through its affiliate, Cie. Independiente Mexicano Americano (CIMA). Actually, Petrofina would not have a concession. Y.P.B.F. would still hold title to the acreage, but Petrofina would finance exploration and development.

Y.P.F.B. would produce the oil and get 30 per cent of production until costs were amortized. Petrofina would get 40 per cent plus 6 per cent interest. A government bulletin which revealed the bids didn't say where the other 30 per cent would go.

After costs are amortized, Petrofina would get 30 per cent of production and Y.P.F.B. would get 70 per cent. Petrofina would give Y.P.F.B. a credit of $4,000,000 to be used for purchasing materials.

Argos, Ltd., offers to start immediately on geological exploration, road building, and staking of wildcats in Madrejones field, which extends over into Argentina and is considered a promising producer of gas condensate. It is slowly being developed by Y.P.F.B.

The Argos combine also would pay a 50 per cent royalty on oil production and 40 per cent on gas. It would build a pipeline from Sicasica to Puno, Peru, or any other line indicated by Y.P.F.B.

Oil & Gas Property would pay a minimum royalty of 11 per cent up to the time recoverable reserves reach 50 million barrels. For each additional 10-million barrels developed, it would pay 1 per cent more until reserves reach 150 million barrels. Royalty on gas and liquid hydrocarbons would be 15 per cent.

Y.P.F.B. would get $1,000,000 in advance of royalties for each 25 million barrels of reserves developed. Reimbursement of this advance payment would be made by giving only 50 per cent of royalties.

Oil & Gas also submitted an alternate drilling-contract plan. It would take 75 per cent of oil plus 6 per cent per year to pay expenses. Y.P.F.B. would get the remaining 25 per cent. After amortization, Oil & Gas would get 45 per cent and Y.P.F.B. 55 per cent.

Madlener y Asociadas made three offers. The first is an advance payment of $7 million, $5 million of which would be spent for drilling during 4 years. The government would get 30 per cent of oil and the company 70 per cent, tax free.

Plan number two calls for a $6-million advance and a royalty payment of 11 per cent. The royalty would increase in relation to increasing reserves.

Plan three offers geological work and drilling in exchange for 10 per cent over the price of products and gas and a 6 per cent interest on the balance. Y.P.F.B. would get 35 per cent of oil and the combine 65 per cent, to be applied to interest, bonuses, and cost of amortization. After amortization, Y.P.F.B. would pay 8 per cent of total production and defray the cost of maintenance and engineering consultation.

Christensen would organize and finance a company to produce, field process, transport, and export all oil produced by Y.P.F.B. The company would be called Bolivian Petroleum Technical Auxiliary Co. (C.A.T.P.B.O.). Its return would be a share in the exported oil.

Y.P.F.B. could export about 4,200 bbl. of oil without further development. It estimates it has 12,000 bbl. daily of potential production, with outlets for 8,700 bbl., the amount now being produced. Consumption is running about 4,500 bbl. daily.

Hawaiian Plant a Step Closer

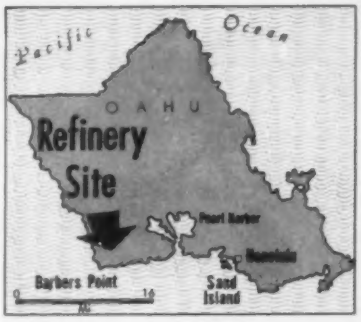
STANDARD OIL CO. of California has wanted to build a $40 million refinery in the Hawaiian Islands for years, but it has never quite been able to make a deal for the site it wanted on U. S.-Government-owned Sand Island just off Honolulu.

Last week, impatient Socal made a conditional contract for another site about 16 miles west of Sand Island. The company has made a preliminary deal with the trustees of the James Campbell estate for 310 acres near Barbers Point, west of Pearl Harbor on Oahu. The estate's trustees have been promoting the Ewa-Barbers Point region as an industrial area for some time.

The deal is not final yet, but neither Socal nor the trustees expect any real troubles in buttoning it up.

Socal didn't actually point its finger at government red tape for the change in plans, but Gordon Macauley, the company's district manager in Honolulu, said Hawaii's growing oil needs mean the refinery must be built soon.

"The possibility of continuing delay in the availability of Sand Island has led the company to seek an alternate site," Macaulay said.



California Standard plans to build a 35,00-bbl. daily refinery, a larger plant than originally planned. The current project cal's for a 10,000-ft. marine loading line off Barbers Point to permit the world's largest tankers to load at 60-ft. depth.

If built near Barbers Point, the refinery will be strategically located for both military and civilian requirequirements. Most of the island's huge military bases are between it and Honolulu.

In big second round of building:

England Expanding Refineries

THREE EXPANSION projects entering their final stages will boost capacity of the vigorous United Kingdom refining industry nearly one-third by the end of next year.

The current programs mark the second big round of refinery additions since the end of World War II. They are costing the participants, British Petroleum Co., Ltd., Shell Refining & Marketing Co., Ltd., and Esso Petroleum Co., Ltd., a total of $127,000.-000.

The three firms are adding 180,000 bbl. of daily capacity. This plus a smaller 6,000-bbl. expansion by Mobil Oil Co., Ltd., will boost the country's capacity to 800,000 bbl. daily by the end of 1958.

This gain still will be only a stopgap in meeting the needs of growing demand, especially for fuel oil, diesel oils, and petrochemical feed stocks. Further expansion plans already under way or on drawing boards will add an additional 170,000 bbl. of capacity daily by the end of 1961 at a cost of another $127,000,000.

Here's what's due on stream next year:

. . . An 80,000-bbl. crude unit will more than double the capacity of the 75,000-bbl. Shell Haven refinery. It will be ready in mid-1958.

. . . A 50,000-bbl. crude unit will open this December at the 90,000-bbl. Isle of Grain refinery operated by Kent Oil Refinery, Ltd., a B.P. subsidiary. A visbreaker, a catalytic hydrogenation unit, a Platformer, and an alkylation unit will be ready next year.

. . . A 50,000-bbl. expansion will be completed at Esso's Fawley refinery. This will raise total capacity to 210,-000 bbl. daily, keeping the plant the largest in U.K.

Mobil Oil is adding the 6,000-bbl. crude unit at its 30,000-bbl. Coryton plant. A Sovaformer also is going in.

More capacity coming . . . B.P. is following up its Isle of Grain expansion with an additional 20,000-bbl. expansion at its 44,000-bbl. plant at Grangemouth, Scotland.

Local officials have approved the project and the new capacity is expected to be on stream early in 1959.

Esso Petroleum is ready to start work on a 100,000-bbl. plant at Milford Haven as soon as anticipated government approval is obtained.

Caltex expects to have a 50,000-bbl. plant on stream within 4 years. The plant will be operated for its U.K. marketing subsidiary, Regent Oil Co., Ltd. The site remains to be selected, since the company-owned land near Southampton may not be in sufficiently deep water to handle big tankers.

Greek Search Ends

Israel firms pull out of Zante Island without oil

THE ANCIENT GREEK may have found asphalt for caulking ships and for the storied Greek Fire on the little Island of Zante off the coast of Greece, but it takes more than that to satisfy a modern search for commercial oil.

Israel Mediterranean Petroleum, Inc., and Pan-Israel Oil Co. have given up the search after only a few months.

The sister Panamanian companies shipped a truck-mounted Mayhew rotary rig to the island early this year to try to find Zante's shallow production (OGJ, Mar. 11, p. 114). Both firms pulled out this month.

The two companies made a deal to spend $150,000 and drill 15,000 ft. of hole to earn a half interest in the concession of American Grecian Oil Co. The latter company was formed by a youthful St. Louis man, Martin Lerman, who obtained a concession on the island from the Greek Government and four private landowners.

Benjamin Heath, president of Israel Mediterranean, said his company gave it up as a bad job after drilling more than 7,000 ft. without results.

Jersey Expanding Refinery

ESSO NEDERLAND N. V. will more than double the initial capacity of a Rotterdam refinery it plans to start next year.

The Standard Oil Co. (N.J.) subsidiary has obtained permission from the Netherlands Government to increase the plant from 40,000 bbl. to 100,000 bbl. daily.

The refinery will be built in the Botlek area of Rotterdam. It will open in 1960. Esso Nederland will export a substantial proportion of the output.

Esso Research & Engineering Co. is responsible for process design. Badger Conprimo N.V., The Hague, will have charge of construction and mechanical design.

Council in Frankfurt, Germany, decides:

U. S. to Get World Congress

THE FIFTH World Petroleum Congress will be held May 30 through June 6, 1959, in the New York Coliseum.

The meeting, expected to draw some 6,000 oil-industry representatives from all over the world, will commemorate oil's one-hundredth anniversary. It was set up by the permanent control council of the World Petroleum Congress in ancient Kronberg Castle, Frankfurt, Germany, the one-time residence of German royalty (see photo).

The World Petroleum Congress is the only true international forum for the exchange of technical information about the oil industry. Meetings as a rule are held every 4 years. There are 35 countries on the group's active rolls.

The organization was formed in 1900, but the world-wide congresses were not identified as such until the 1933 meeting in London. The second congress was held in Paris in 1937, the third in The Hague in 1951, and the fourth in Rome in 1955.

The permanent council was organized at the Paris meeting. Dr. E. V. Murphee, standing in the picture, is council chairman. He is president of Esso Research & Engineering Co.

Latest developments in equipment and technology for petroleum and petrochemicals will be exhibited at the New York meeting. The program covers these nine sections:

Geology and geophysics; drilling and production; oil processes; chemicals from petroleum and natural gas; composition, analysis and testing, measurement, and control; utilization of oil products; construction of equipment, and materials, and corrosion; transportation, distribution, and marketing; and research, statistics, and education.

Indonesia Switch

Army replaces ministry as Sumatra fields authority

THE INDONESIAN Government has apparently switched signals again in the political ball game over the future of the 10 oil fields in northern Sumatra.

Before World War II, the fields were produced by a company in the Royal Dutch-Shell group and added 22,000 bbl. daily of high-gravity crude to Indonesia's production. For years after the war, Shell hoped to get them back. Last year, the government said no (OGJ, Nov. 5, 1956, p. 83).

Earlier this year the government gave its ministry of economic affairs authority over the fields and the ministry was supposed to set up a company to handle operations (OGJ, June 24, p. 122). Recently, the ministry said in Djakarta that the army is taking over to "speed up reconstruction and development."

The plan now is to sell the crude to all takers on an f.o.b. basis with the hope that U.S. buyers will finance a pipeline to Pangkalan Susu, the nearest shipping point.

At least one Japanese refiner says it is interested. Marzuren Oil Co., which operates two refineries with a combined throughput of 47,500 bbl. daily, has plans to buy the Indonesian crude.

Marzuren wants to shuttle small 2,000 to 3,000-ton tankers back and forth between the Japanese islands and Pangkalan Susu, hauling from 70,000 bbl. to 200,000 bbl. of the highly aromatic crude a month. The company is dickering with the Indonesian Government for payment of the crude in soft currencies.

Japan Laying Marine Line

THE JAPANESE will start pipelaying operations next month for what will probably be the longest large-diameter marine-loading pipeline in the world.

The 30-in. pipe, in two separate sections, will lie on the bottom of Tokuyama Bay. It will link Japan's newest 35,000-bbl. refinery with a sealoading berth that will accommodate the world's largest tankers.

The first 10,594-ft. section of the marine line will connect the loading berth and a 350,000-bbl. tank at Oura. The tankage is to be linked by another 9,446 ft. of line on the bay bottom to the refinery at Tokuyama.

Idemitsu Kosan only recently completed the refinery on the site of what was once a petroleum depot for the wartime Japanese navy. The new refinery will operate on Middle East crudes, supplied primarily by Gulf Oil Corp. from Kuwait and Standard Oil Co. (N.J.) from Saudi Arabia. The marine pipeline is expected to be completed in February 1958.

Middle East Cut Sticks

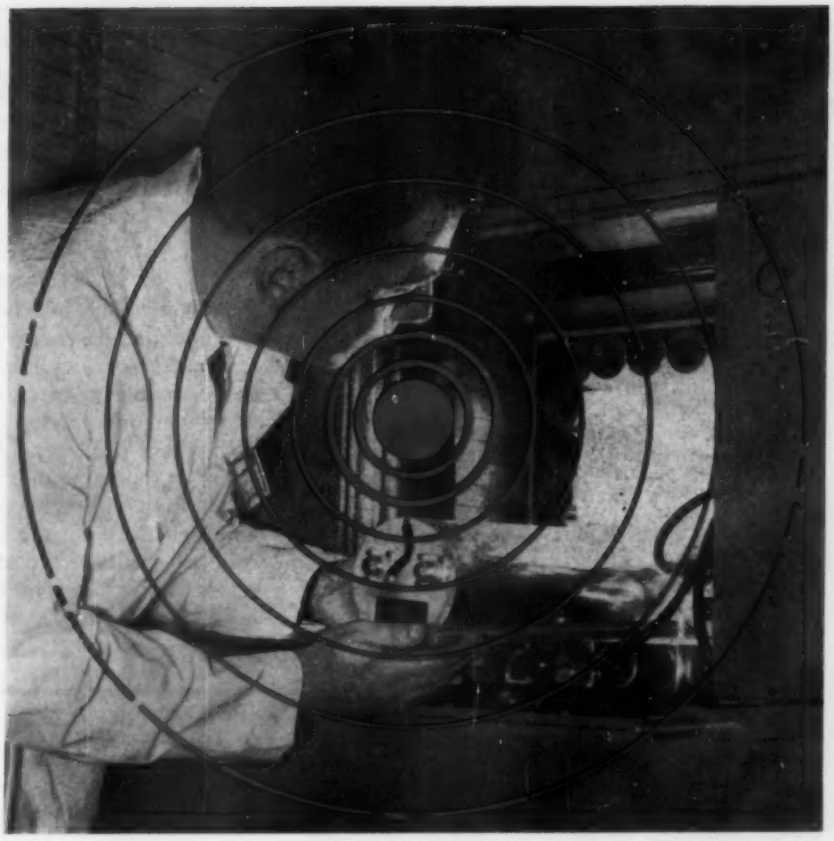
OTHER MIDDLE EAST offtaker companies have followed the lead of Esso Export Corp. in reducing the price of crude at Eastern Mediterranean terminals by 10 cents per barrel.

Mobil Overseas Oil Co., Inc., Shell Petroleum Co., Midwest Crude Sales Co., and BP Trading, Ltd., made their moves a few days after Esso Export lowered the price to $2.59 per barrel for 36°-36.9° gravity crude. There is a 2-cent per barrel increase for each degree gain in gravity.

The new prices affect Saudi Arabian crude delivered at Sidon, Lebanon, and Iraqi crude at Tripoli, Lebanon, and Banias, Syria.

Esso Export cut the price to compete with reduced ocean-transportation costs from the Persian Gulf resulting from lower charter rates for tankers (OGJ, Sept. 16, p. 119).

FIRST USE OF ISOTOPES to study the causes of deposits in automobile engines. The method calls for adding small quantities of radioactive isotopes to gasoline. The mixture is then run in a test engine. Then, by analyzing the radioactivity of combustion-chamber deposits, it's possible to spot harmful components. Here, Dr. Leon Shore of Esso Research & Engineering Co. is putting a cylinder of the deposits, which have been gassified, into a radioactivity measurement chamber.



REFINERS IN ISOTOPIA

How ISOTOPES work for REFINERS

And what we're seeing now is "merely the beginning in realizing benefits both from isotope usage in everyday applications and eventually from radiation energy itself."

By George Weber, Refining Editor

RADIOACTIVE ISOTOPES are taking on added importance in refineries. They have emerged from the laboratories and are now used in a wide number of applications to routine processing and maintenance.

But their common application is still largely restricted to a few of the major oil companies which adapted research techniques to improve commercial operations. Radioisotopes are neither expensive nor dangerous when properly handled. Their potential application in refineries, large and small, is so promising that they should eventually receive attention from the whole refining industry.

The foregoing sections of this symposium (see box on p. 93) have outlined a selected number of the newer techniques which have proved successful in everyday operation of a refinery. This final report will summarize briefly the known applications of radioactive isotopes in evaluating, expediting, simplifying, and economizing refinery operations. The list is growing fast, and this should be considered only as a progress report.

General applications . . . The sale of radioactive isotopes by the Atomic Energy Commission has become big business.[1] Industry in general is embracing these new tools. But nowhere are they gaining more widespread use than in the petroleum industry.[2,3]

Products of the ATOMIC AGE . . . *and how they're used*

1. Penetration of radiation. Measurement of the absorption of radiation by substances located between the isotope source and a radiation counting device.

2. Reflection of radiation. Measurement of radiation energy reflected by substances exposed to radioisotopes.

3. Luminescence. Employing radioactive isotopes to cause certain materials to emit light when exposed to radiation.

4. Ionization. Putting to use the ability of atomic radiation to ionize most materials.

5. Sterilization. Use of radiation to destroy bacteria and enzymes in a material without raising the temperature or otherwise altering the character of the material.

6. Voltage production. The production of electrical energy by exposing certain materials to radiation.

7. Tracer techniques. Detection of the presence, location, and relative concentration of radioisotopes by measuring their radiation.

8. Activation of chemical reactions. Use of radiation energy to trigger chemical reactions which might be impractical or impossible to carry out by means of heat, light, or catalysts.

Of these eight general techniques, refiners have put to use those employing penetration and reflection of radiation, and tracers. The effect of radiation on refinery chemical proceses is now under serious study, but commercial application is still believed to be some distance in the future.

According to the Atomic Industrial Forum, Inc., industrial users of radioactive isotopes have increased fivefold since 1951. More than 60 different companies in the petroleum industry have used these new tools in some way. Most of them have restricted their usage to commercial instruments for thickness gaging, density measurement, etc.[3]

While other industries show a larger number of companies participating, none has used radioactive isotopes in such variety and volume as the petroleum industry. Internally, these valuable tools are finding use in exploration, drilling, production, and pipeline divisions. But refining accounts for the greatest commercial usage to date.

A recent survey revealed that the petroleum industry saved an estimated 10 million dollars last year through the use of radioisotopes. All industry should realize savings of at least 1 billion dollars in the next 10 years in the same manner.

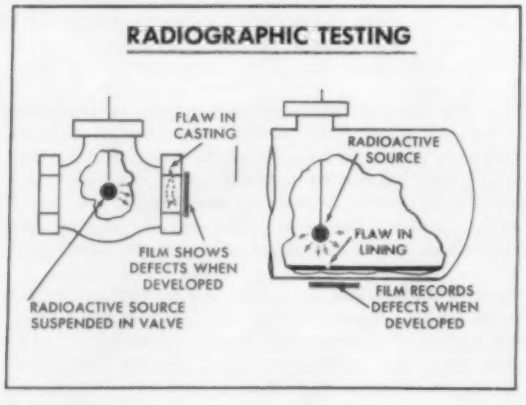
The establishment of a radioisotope facility, be it a simple testing device or a complete radiation laboratory, calls for a serious open approach to safety and education.[4] The course of establishing employe, family, and community acceptance is well charted.[5]

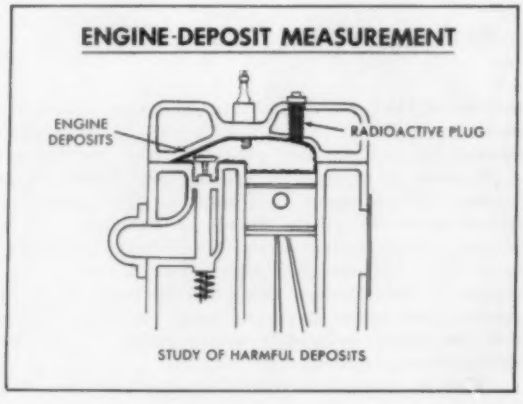
1. Penetration of Radiation

The use of radiography for nondestructive examination of metal parts was well established before the advent of the nuclear reactor. But the availability of such gamma-ray sources as cobalt-60, cesium-137, and iridium-192 has greatly lowered the cost of radiography sources. For example, $100 worth of cobalt-60 gives the same radiation intensity as $20,000 worth of radium, and the gamma rays from radiocobalt having a higher energy are more penetrating than the gamma rays of radium.

Radiography "cameras" using the new isotopes are more portable than conventional X-ray devices

Isotopes are being used to determine equipment defects and deposit thicknesses





Measuring liquid level by radioactive means is widely used

and can be used in refinery locations inaccessible to X-ray examination. Radiography quickly detects lead-lining failures in vessels handling sulfuric acid.[6] It also provides a fast, accurate method for discovering flaws in such items as furnace-header castings and heater tubes.

Many refiners have purchased their own sources or thickness gages for routine examinations of equipment for thickness and detection of flaws or corrosion. Many others avail themselves of testing services using these new types of equipment.

Deposit measurements . . . Aside from the routine inspection of metal wall thickness in vessels and lines, refiners are finding radioactive isotopes useful in automotive laboratories. Formerly, evaluation of the effects of various fuels and lubricants on engine deposits was a long and costly operation. Engines were run for many hours to give sufficient deposit buildup. They were then torn down and deposits removed by scraping or solution to be weighed.

The isotope method consists of preparing the deposit area by incorporating or depositing a suitable beta-ray emitting isotope, such as sulfur-35, nickel-63.[7] Following a brief period of engine operation, the areas are reexamined with sensitive instruments measuring beta radiation.

The soft beta rays are partially absorbed by the deposit laid down over the isotope layer. It is possible to measure the amount of this absorption with sensitive radiation-measuring devices, and deposits of only a few hundredths of a milligram per square centimeter can be detected.

The speed and accuracy of this method have vastly broadened the field of evaluating fuels and lubricants for their deposit characteristics on such engine parts as spark plugs, combustion chambers, intake manifolds, carburetors, etc. The same technique is also applicable in measuring thickness of scale deposits on boiler tubes, corrosion scale, protective films, and plating.

Density gaging . . . The absorption of gamma rays by any material is proportional to the mass per unit area of the substance.[8] This principle is used in measuring the density of various products being batched through a line, to detect interfaces. It is also finding increased use in determining the density of both the dense and dispersed phases in fluidized catalyst or fluid coke beds.

Cobalt-60 or cesium-137 are commonly used as gamma-ray sources and the penetrating properties of this type of radiation permit external measurement of fluids and fluidized solids in closed vessels and lines. This technique can also be applied to detect foaming in a vessel and to locate the interface in two-phase systems.

Liquid-level gaging . . . Measuring the height of a liquid level in a closed vessel by radioactive means has been widely adopted in refineries.[9] In many cases extreme temperature and pressure conditions and corrosive atmospheres make the use of conventional floats, gage glasses, and hydrostatic pressure indicators impracticable if not impossible.

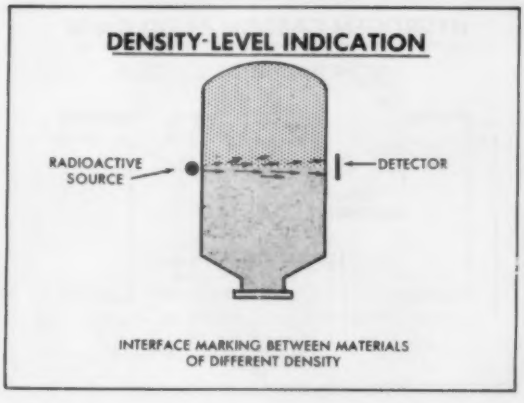
Liquid levels can be detected by gamma-ray absorption of the liquid, using external equipment altogether. This is done in three ways.

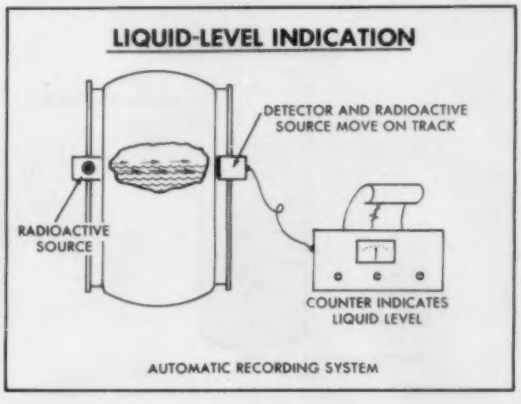
A radioactive source, such as cobalt-60, can be located at a fixed level an one side of a vessel, and the liquid level can be located rapidly by scanning the opposite side with a scintillometer or counter. This simplest method is usually employed for other than continuous readings.

Previous articles in this series:

1. Radioisotopes Help Solve Refinery Problems, by George Weber, OGJ, August 27, 1956, p. 99.
2. Radioisotopes Solve Five Refining Problems, by B. A. Fries, D. E. Hull, and S. B. Jones, OGJ, October 8, 1956, p. 268.
3. Determine Hydrogen Content in a Hurry with Sample Detector and Strontium-90, by Frank J. Piehl, OGJ, October 15, 1956, p. 133.
4. Shell Puts Radioisotopes to Work, OGJ, January 7, 1957, p. 111.
5. Are You Overlooking Nuclear Radiation?, by Frank H. Low, OGJ, February 4, 1957, p. 121.

Both density-level and liquid-level indication are made by gamma-ray absorption





Sharper readings can be obtained by moving the radioactive source to the level indicated by the first step above, then taking another height reading with the detector. This refinement is used for example in determining the height of a liquid or fluidized solids bed for correlation with other factors in studying a unit's performance.

Continuous liquid-level readings have become routine in some cases, using a permanently installed system. Depending on the accuracy desired, such systems comprise the following combinations: Multiple source-single detector; single source-multiple detector, or multiple source-multiple detector.

In addition to these strictly external devices, the radioactive source may be placed in a float inside the vessel. This has one advantage in that the vessel walls serve as a shield, protecting personnel without additional shielding expense.

Depth gaging . . . A third method places the source above and detector below the liquid column to be measured, or vice versa.[10] The radiation absorption of the liquid is determined at known liquid levels for calibration purposes. This system is used in controlling the liquid level of tar in thermal cracking reactors. [11] In such cases, the cobalt-60 is usually installed permanently inside the vessel to take advantage of the natural shielding.

Liquid-level control . . . Radioactive systems can be used to control as well as measure liquid or solid levels. Controls or warning systems can be actuated by either vertical or horizontal scanning of the liquid column. This approach is being used to switch input from one coke drum to another when the coke level reaches a given point.[12] When using cobalt-60 or other isotopes emitting strong gamma rays, this system will work satisfactorily on vessles of large diameter, for example 20 ft.

Continuous analysis . . . Laboratory instruments utilizing radioisotopes for determining sulfur content, hydrogen-carbon ratios, or hydrogen content of hydrocarbon streams are now in use. Due to its high relative absorption of gamma and beta rays, the hydrogen content of a fluid of known density can be determined by radiation absorption. This technique shows promise of commercial application in rapid determination of hydrogen content or hydrogen-carbon ratios in various refinery streams.[13] It should prove valuable in catalytic reforming, hydrogen treating, dehydrogenation, and other processes.

Beta-ray absorption instruments utilize a sidestream or sample, since beta radiation will not penetrate steel pipe walls. For accurate results with gamma rays, a sample thickness of about 1 m. is required. This requirement can be met in many commercial units where hydrogen content can be determined on full streams, with the source and detector installed outside steel lines or vessels.

Sulfur content of hydrocarbon streams has been measured by proper calibration of its absorption characteristics for X-rays or gamma rays. It is possible that this laboratory and pilot-plant application may someday find commercial application in the refinery.

2. Reflection of Radiation

A number of industries are using the calibrated measurement of back-scattering or reflection of beta radiation to measure the thickness of films laid down on metals. This has application in measuring the thickness of paint or other protective coatings, from one accessible side.

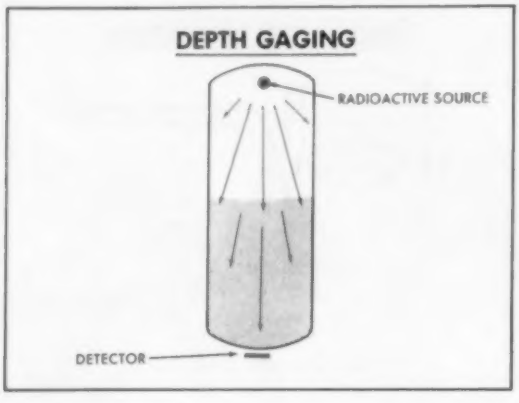
Reflection of radiation by liquid in a closed vessel is used to determine liquid level. This technique finds application in inaccessible locations where it is impossible to locate the source and detector on opposing sides of a vessel for the conventional measurement of radiation penetration.

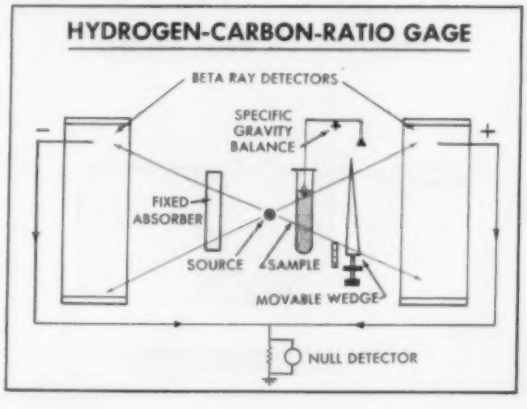
3. Tracing Atoms

One of the first tracer applications was in **wear studies.** Piston rings were tagged with radioactive P^{32} which had been irradiated in a cyclotron. The rings were installed in an engine and the degree of wear after brief periods of operation was measurable by detecting the amount of radioactive material which had worn from the rings and entered the crankcase with the lubricating oil.[14]

This procedure gained rapid acceptance when piston-ring irradiation became possible at low cost in atomic piles. It has since been extended to wear studies of gears, bearings, cam followers, and numerous other moving engine parts.[15 16] The rapid, accurate results of this technique have accelerated the evaluation of fuels and lubricants. Wear studies of irradi-

Radiation absorption is used in liquid gaging and in getting hydrogen content





Liquid flow is measured by installing two detectors along a line

ated cutting tools have also been conducted to study the properties of cutting oils.[17]

Catalyst flow . . . In vapor-lift, moving-bed catalytic cracking units, measurement of catalyst-flow rates can be accurately determined only by radioactive means. As an example, one or more catalyst pellets is impregnated with zirconium-95 and fed into the catalyst system of the unit.[18] Two detectors connected to a common recorder are located at the top and bottom of a seal leg or other desired points in the catalyst system.

Given the measured distance between the points of detection, the cross-section of the pipe, and the catalyst density; elapsed time of passage of the radioactive pellets can be calibrated directly as catalyst circulation rate. Five to ten radioactive pellets in a system totaling some 20,000,000,000 are sufficient to give flow-rate readings with satisfactory frequency.

Fluid-catalyst studies . . . Radioactive-tracer techniques have opened an entirely new field of study in fluid catalytic cracking. They are now used for the measurement of catalyst flow, mixing, loss, and deactivation to a degree never remotely possible by any other means.[19 20 21 22 23 24 25]

Fluid catalyst impregnated with cobalt-60 has been used in studying the mixing pattern and stack loss of catalyst in a commercial unit.[26] In another study, fresh fluid catalyst impregnated with scandium-46 was injected into a commercial unit to follow the deactivation of fresh catalyst under routine cracking operations.

A further project used fluid catalyst tagged with scandium-46 and cerium-144 to trace flow patterns in three catalytic cracking units.[27 28] Similarly tagged fluid catalyst particles were employed in stack-loss studies.[29] Gas-mixing characteristics in a fluid-bed regenerator were studied using helium as a tracer, and further investigations are planned employing krypton-85.

The latest achievement of this new technique was the tagging of three different catalysts in the same commercial system. This triple-tagging method using three isotopes whose radiation could be separately detected, led to a successful study of the relative performances of the three catalysts under identical operating conditions.[21]

Liquid flow . . . A common means of determining liquid flow employs two detectors installed along the length of a uniform section of line. Both are connected to a common recording chart. A gamma-ray emitter such as cobalt-60, antimony-124, cesium-134, or barium-140 is injected rapidly into the line and passage of the radiation peak is recorded. Measurement of the elapsed time between the response of the two detectors permits calculation of the linear velocity of the liquid.

Given a pipe of uniform size with no connecting branches between the detection points, volume flow rate is easily computed. Isotope quantities of only a few tenths of a millicurie give good results in pipe sizes up to 10-in. diameter.

The tracer dilution method is also used to measure flow rates.[30] A radioisotope solution at known concentration is bled into a pipeline at a fixed rate. A count rate meter placed downstream of a mixing device such as a pump measures the concentration of tracer in the total liquid in the line.

This concentration, related to concentration and injection rate of the tracer solution permits calculation of the total flow rate in the line. This method has been used successfully in measuring the volume of waste water in refinery waste-disposal systems.

A third approach to measuring liquid flow in a line employs the total-count method.[31 32] This also eliminates the need for the second observation point downstream from the injection point. It can also be used when the volume between two points on a line is unknown. A definite quantity of gamma-emitting material is injected into the system.

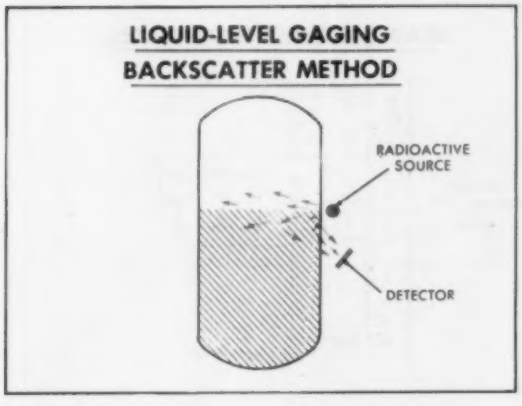
Downstream at any point, a Geiger counter measures the total emission from the radioactive material as it passes the point. This integrated count is independent of the variation in radioactivity along the stream, so long as the liquid flow rate is constant.

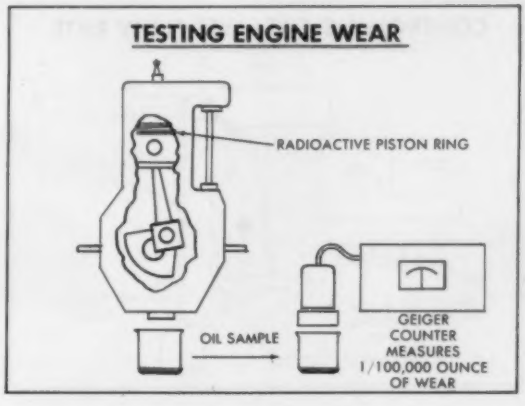
The total amount of gamma radiation recorded is inversely proportional to the velocity of flow. Flow-rate determinations can be obtained by calibrating the counts on the pipe size involved. A cut section of the pipe is filled with a known concentration of the tracer solution, and the counting rate is taken with a detector attached to the pipe. This gives a calibration factor:

$$K = \frac{\text{Counts/second}}{\text{Millicuries/bbl.}}$$

which can be transposed to:

Radiation reflection and wear in radioactive metal are useful measurement tools.





$$K = \frac{\text{Counts/millicure}}{\text{Bbl./second}}$$

Given a known number of millicuries injected into the line, the total count can be translated into the flow rate, using this factor. The total-count method can be used to measure flow of a wide variety of plant streams. It has found use in calibrating pipe ranging from 1 to 14 in. in diameter, with varying wall thicknesses, and with or without concrete or magnesia linings.

Gas flow . . . The first method outlined for liquid flow, timing the passage of radioactive peaks, is less satisfactory when measuring gas flow because of the rapid mixing that occurs. Gas-flow rates are better obtained by using the tracer dilution or total-count methods.

Leak location . . . Both the point of leakage and the volume of loss can be determined in buried pipelines by injection of small amounts of gamma emitters in the line or system. Leaks between cross-streams in a heat exchanger can also be checked easily through the use of a tracer miscible in both streams.[33 34]

The tracing of waste seepage or leakage into streams by chemical means is sometimes impossible to check because of the considerable dilution which takes place in the streams. Injection of radioactive tracers in the suspected source of pollution is also ruled out in many cases to prevent admission of radioisotopes into public streams.

Such possible seepage can be definitely determined by subjecting samples of the stream above and below the suspected point of entry, to irradiation in an atomic reactor. Seepage elements can then be detected in extremely small quantities, by measuring their radioactive emissions after service irradiation. The same technique may be applied to air-pollution studies.

Volume and residence time . . . The tracer-dilution technique represents the only means of measuring liquid volumes in many closed systems because of their irregularity.[31 32] Foaming prevents accurate liquid gaging in other instances. If mixing occurs, either by circulation or internal agitation, accurate volume measurement is possible by the dilution method.

A known volume of radioactive material miscible in the liquid is injected and allowed to mix thoroughly. Concentration is then measured and related to volume and concentration of injected material to determine total volume.

This method also gives good results in measuring the volume of one phase in a mixture of liquids, such as acid in an acid-hydrocarbon mixture in an alkylation reactor. In such cases, radioactive compounds soluble only in the subject phase must be chosen.

The tracer-attrition method is also used to determine liquid volumes in tanks or vessels through which there is a constant liquid flow.[33] Assuming that complete mixing of tracer and liquid exists in the vessel, the concentration of the tracer in the tank will decrease exponentially. This decrease, related to flow rate through the tank or vessel, gives a computation on volume:

$$\frac{-d \ln c}{dt} = \frac{R}{V}$$

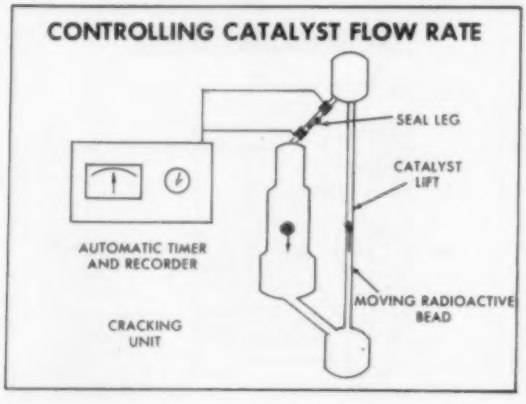
where c = concentration of tracer
R = throughput rate
V = volume of vessel or system

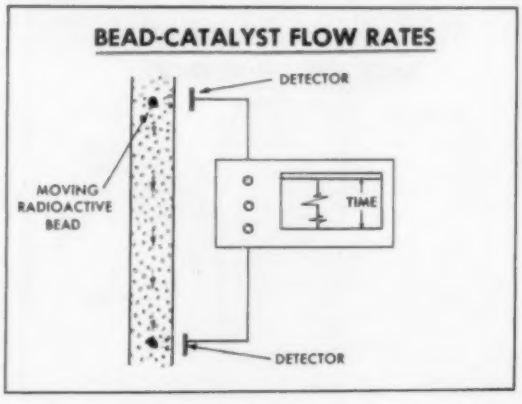
An alkylation unit was checked by this method. After injection of an acid-soluble tracer, radioactivity of samples was measured over a 30-hour period and plotted on logarithmic coordinates. The known throughput rate divided by the slope of this plot gave the volume of the acid in the unit. The same determination could be made on volume of hydrocarbon liquid, using a tracer with selective solubility for that phase.

In some refinery units involving circulating systems the tracer-attrition method will not work because the radioactive tracer injected into a vessel or tank does not mix with its total contents before leaving the vessel. In such cases, the peak circulation method is used to measure volume.[35] A single dose of radioactive tracer is quickly injected into the stream and a detector is placed at one or more convenient points in the circuit.

A recorder plots the passage of two or more radioactive peaks as the tracer batch circulates with the main stream. By relating the time interval between peaks to the flow rate at the detection point, the volume of the system can be accurately determined. This method has been used with success in the heavy-gas-oil reflux line of a large vacuum distillation column.

Catalyst flow rates are controlled and studied in both moving-bed and fluid units.





Spot injection of tracer is used to mark the interface in lines

The radioactive cobalt-60 tracer provides a measurable peak three or four times before merging with the background, and the intervals of passage of these peaks showed sufficient uniformity to indicate accurate volume measurement of that section of the column.

Residence time . . . Whenever the mixing time is short with relation to residence time in a closed system, mean residence time can be measured by the tracer-attrition method discussed. In this case, mean residence time equals the time for tracer attrition to reach a value of 1/e of the original, or the reciprocal of (d ln c)/dt in the equation. Residence time in thermal cracking and alkylation reactors is measurable by this method.

Tracing flow paths . . . Radioactive tracers have been used to trace the flow of liquids in units during operation.[31 32] In one case it was suspected that not all bubble caps in a large vacuum column were properly submerged, since heavy metals were entraining upward into a gas oil side stream.

Triphenyl stibene containing radioactive antimony-122 was injected into the column and eight Geiger counters were placed outside the column opposite the eight tray channels. Four of the counters gave a strong count as the liquid flowed down, on one side, but the other four showed weak or no response. This strong indication that unscrubbed vapors were passing upward on one side of the tower was verified when the plant was brought down for a turnaround.

The same technique was used in checking catalyst flow in moving-bed cracking units. Baffle systems designed to provide uniform flow of catalyst have been evaluated by scanning lines and vessels to detect the passage of radioactive catalyst pellets. Differences in both the speed and number of transits of these tracers has permitted operators to adjust baffling and orifice plates to obtain more uniform flow.

Interface marking . . . This technique, first used to detect the interface between product tenders in pipe lines, also has application in the refinery. Spot injection of radioactive tracers in plant lines can measure the degree of mixing in lines, and designate switching points to minimize contamination of two or more streams.[36 37 38]

The ability to trace an interface between two different types of feed stock moving through a commercial refining unit can be an important advantage in segregating products. In some cases, experiments with radioactive tracers will show whether sharp segregation is possible.

For example, when two crudes are fed alternately to a distillation unit it is often desirable to keep segregated the heavy bottom fractions. One such case involved a battery of four distillation units.[7] Ten millicuries of radiocobalt naphthenate was injected at the interface when crudes were switched to the unit. The tar line leaving the battery was monitored with a Geiger counter.

From throughput rates, the theoretical interval between injection and peak activity at the tar line leaving the battery was computed. In practice it was found that first activity was registered well in advance of this time, and the interface of mixed crudes persisted over such a broad and diffuse period that it was not practical to make a sharp segregation.

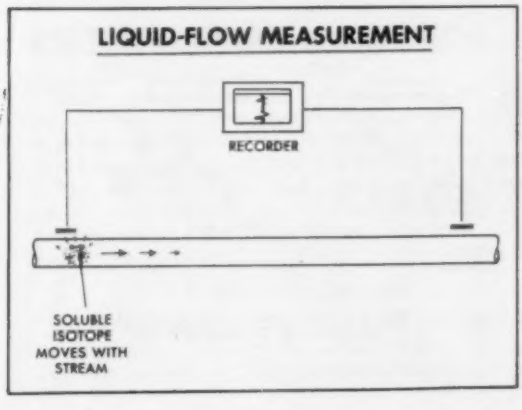
Where shorter throughput periods are encountered in commercial units, and mixing does not approach ideal, the radioactivity interface can be of use in segregation. A plot of the activity curve on the effluent line will provide a choice of switching points dependent on how much contamination can be allowed in either stock.

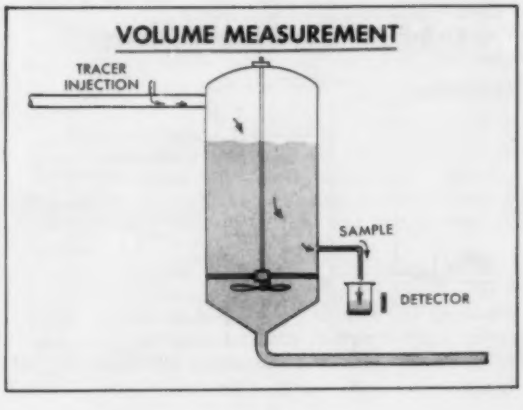
Mixing and blending . . . In some instances a high degree of mixing or blending is desired when switching from one feed to another. In thermal cracking, it is easier to adjust conditions for processing a new feed stock if the change is gradual rather than abrupt. A surge tank with a side loop for mixing, when installed ahead of the unit, serves this purpose.

By means of a radioactive tracer injected at the inlet of the charge pump, the efficiency of mixing in the surge tank can be evaluated, and the adjustment of conditions can be more properly timed.[33] By monitoring the line from the surge tank to the thermal unit, the amount of mixing can be measured by the dilution method. Incomplete mixing shows up when alternating streams of high and low activity continue for a long period after initial tracer injection.[7]

In many cases, mixing efficiency can be improved in a batch operation by keeping mixing periods within practical limits.[39] A soluble radiotracer is injected into a vessel whose contents are being blended by circulation, jet action, or mechanical mixers. By scanning a

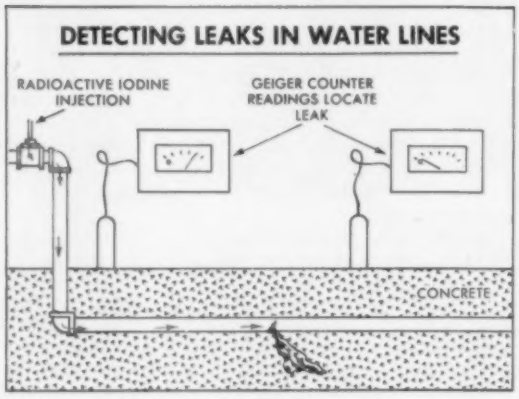
Flow measurement depends on isotope movement; volume, on tracer dilution.

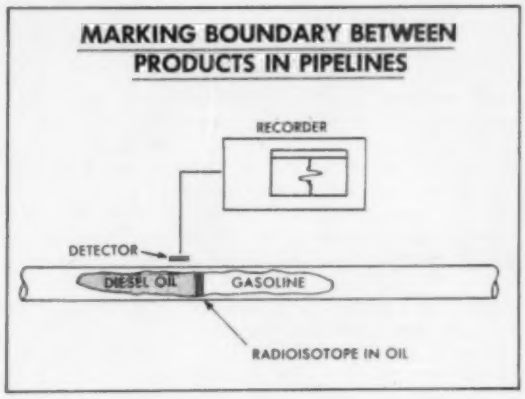




REFINERS IN ISOTOPIA

Radioactive tracers injected into liquid streams can detect leaks; mark interfaces





cross-section of the mixture at some point distant from the injection point, the leveling-out period of activity indicates the point at which mixing becomes complete for all practical purposes.

Where mixing conditions are held constant, one test will serve to set the mixing time for subsequent operations. This same technique is applicable to the study of in-line blending which is gaining popularity.

Gas mixing . . . Quantitative measurement of gas mixing in the regenerator of a fluid catalytic cracking unit is possible by means of radioactive tracers. In one such study, helium was injected at selected points in the fluidized bed. Gas samples were withdrawn and analyzed for helium by a spectrometer. This method gave the desired information, but involved large quantities of helium.

Similar studies on another commercial fluid unit are planned, using krypton-85 which is radioactive. Only 10 ml. of this tracer gas, having a strength of 40 mc., will suffice. Even when diluted in an inert gas, this radioactive tracer will require about 1 per cent of the input volume required of helium.

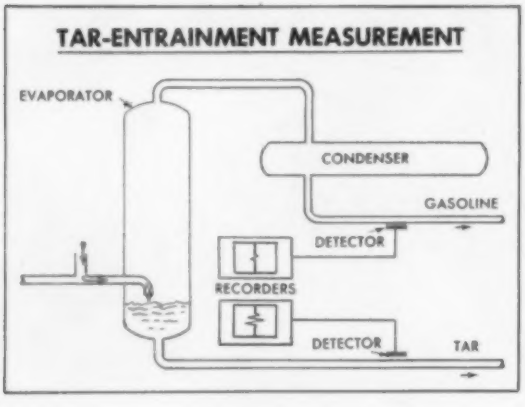
Separation processes . . . In studying mixing or blending, the operator has a wide choice of radioactive tracers, since they do not need to be selectively soluble. But in separation studies aimed at tracing a particular compound, the tracer must be similar in physical and in some cases chemical characteristics. Hydrocarbons labeled with carbon-14, sulfur-35 or hydrogen-3 (tritium) are useful in such cases.

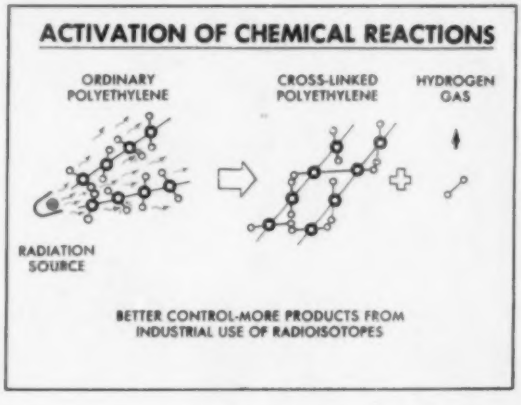
These isotopes give off relatively weak beta rays and cannot be monitored through steel vessels and lines like the gamma-emitting tracers. Some laboratory work has been done in distillation using these isotopic tracers.[45] This points to the possibility of tracing specific hydrocarbons or hydrocarbon groups in commercial distillation and solvent extraction processes by examination of withdrawn samples or by the use of dipping scintillation detectors.

Entrainment . . . The widest application of tracers in separation processes has been the study of entrainment of heavy oil in distillation units. This involves the labeling of a phase or group of hydrocarbons with nonvolatile tracers which are soluble in only the residual fraction.[21 34]

Cobalt-60 naphthenate has proved satisfactory in verifying and measuring the amount of heavy-oil entrainment in vacuum towers.[7 33] Two injection methods are used. The tracer can be injected rapidly in batches, in what is called the pulse method, and the time interval between injection and show of activity in selected overhead streams gives an indication of where entrain-

Isotopes do such widely different jobs as measure entrainment and start reactions





ment is taking place. In the steady-state method, tracer is bled into the feed over a given period and the relative activity in overhead and sidestreams shows the degree of entrainment of heavy oils.

Entrainment studies are not restricted to heavy oil. In Unisol units, gasoline is pretreated by caustic scrubbing to remove aliphatic acids and mercaptans. If caustic is carried over by entrainment with gasoline to the next stage of the process, fouling by aliphatic salts takes place.

This caustic entrainment can be measured with accuracy by adding antimony-124 in the form of sodium antimonate to the caustic wash. Another method for tracing caustic entrainment in settling tanks has been tried, using sodium-24 as the element.

Combustion studies . . . Like most engine-wear tests, the study of combustion characteristics of various fuels takes place in the laboratory rather than in the refinery proper.[40] However, more and more engine laboratories are being installed at refineries and work of this type might be classed as control testing in some cases.

The formation and measurement of engine deposits resulting from various fuel blends can be studied by tagging fuel components with radiactive elements. However, actual deposit thickness is more readily measured by radiation absorption than by tracer techniques.

Process analysis . . . The use of isotopic tracers, i.e. hydrocarbons labeled with radioactive carbon, hydrogen, etc., in studying reactions is a research laboratory project.[31,32] But the performance of commercial processing units can be judged by this technique, making it of interest to the plant operator.

Reaction mechanisms have been traced with accuracy in catalytic reforming and isomerization through the labeling of hydrocarbons of interest with carbon-14. Hydrogen transfer and coke formation can be traced directly.

This type of work relating to both research and operations may be expected to gain in use. Of all the common elements, only oxygen and nitrogen have no practical radioactive isotopes. The field for further study of commercial reactions in refining is broad.

Activation analysis . . . The exposure of samples in atomic reactors in order to detect very minute concentrations of certain elements offers another service to refiners.[39] Carbon and hydrogen do not become very radioactive when bombarded by neutrons, but many metallic elements do.[41] For example, the vanadium content of a crude or a catalytic cracking feed stock can be measured in extremely small concentrations by irradiating a sample in a nuclear reactor and measuring the radioactive vanadium content.

Suspected pollution of public streams by liquid refinery wastes can be checked by activation analysis with complete safety. Even though dilution is great in such cases, operators hesitate to add radioactive tracers to their effluent streams. But samples taken at various points along a stream can be activated and analyzed for impurities without any danger whatever of any radioactive pollution.

4. Radiation Chemistry

This new phase of radioactivity has no application to commercial refining—yet. But research is under way in a number of laboratories, investigating the possibilities of employing atomic energy in the conversion of petroleum.

There is still some question whether the large-scale use of this new form of energy will be practical. However, the doubters are becoming fewer every month. The one development which will open the door to commercial investigations is the dual-purpose reactor. To date none has been designed or built. But authorities in the field believe that it will be possible to design a nuclear reactor which will fulfill its primary purpose of generating power, and make available tremendous amounts of radiation in addition.

Today's reactors waste their radiation in shielding. When it becomes possible to use this radiation to bring about chemical reactions, the potential for radiation processing should become vastly improved.

Small-scale work . . . Meanwhile, small-scale laboratory projects are under way and some interesting results are already being reported. This type of research is considered to be in its infancy. The first line of attack is to find out precisely how gamma and other types of radiation affect petroleum hydrocarbons. This approach will indicate what reactions might prove worthy of further investigation.

Polymerization, chlorinization, and isomerization look promising. Additional processes may come to light as the research program unfolds.

For the present, a number of isolated and related phenomena indicate the future of radiation processing. For example, small samples of crude fractions on exposure to radiation in a reactor, have "cracked" to produce lighter products including gasoline and other distillates.

Butane when exposed to beta radiation in a Van de Graaf accelerator forms unsaturates which polymerize to octenes, octanes, and higher-molecular weight hydrocarbons. In addition to breaking the carbon-hydrogen bonds, this type of irradiation also severs the carbon-carbon bond in isobutane to form C_3 fragments. This results in large amounts of C_7 hydrocarbons.[42]

Chemical work . . . In the chemical field a number of findings are of potential interest to the petroleum industry.[43] Ethylene under gamma radiation polymerizes to form a tough polyethylene.[44] Polyethylene produced by conventional means becomes crosslinked when gamma-irradiated. This raises the melting point and improves tensile strength.

Hexane has been converted to formaldehyde and ammonia to hydrazine when subjected to radiation. Rubber becomes vulcanized. Paraffin wax when exposed to radiation becomes an insoluble rubberlike material. Irradiation work is progressing on lubricating-oil fractions. While no results have been verified, the findings are reported unofficially to be highly interesting.

While radiation processing is still several years away, the need for research on that future possibility is an immediate one. Those companies expecting to benefit directly from this potential processing tool must initiate work promptly, or they will find themselves left behind.

The progress of petroleum refining in utilizing radioactive isotopes has placed the industry in the forefront. This is believed to be merely the beginning in realizing benefits both from isotope usage in everyday applications and eventually from radiation energy itself.

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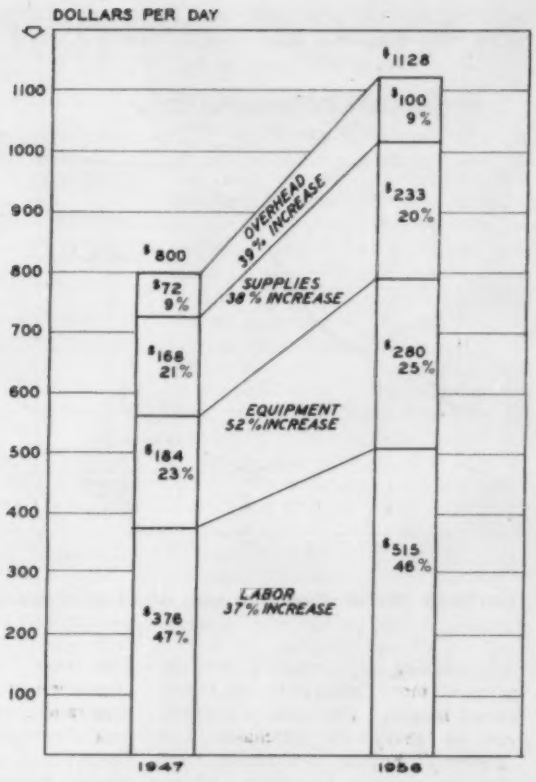
"The progress of petroleum refining in utilizing radioactive isotopes has placed the industry in the forefront. This is believed to be merely the beginning in realizing benefits from isotopes usage in everyday applications."

What It Costs To Drill Wells In California

. . . in which a drilling contractor and an oil-company representative voice their respective views

Part 1 — By R. C. Sharp

Kellogg Overseas Corp.



CHANGE IN OPERATING COSTS, daily basis, from 1947 to 1956. Fig. 1.

DURING the years from 1947 to 1956 the contractors' daily operating costs in California have increased 42 per cent. In this same period the rate of penetration has increased 48 per cent, resulting in an actual reduction of 16 per cent in footage prices. In the face of increasing daily costs of drilling and increasing problems such as deeper drilling and drilling in residential and offshore areas, future drilling in California will require closer cooperation and understanding between operators and contractors.

If the over-all cost of finding and producing a barrel of oil in California becomes too far out of line with these same costs in Texas, Oklahoma, or even in the Middle East, then no producing company can or will produce the California oil. It follows then that all of us in the producing end of the oil industry in California must be concerned with costs if we are to survive, and this is true whether we are producers, supply people, or contractors.

Drilling costs are of paramount importance to all of us. Consider that out of a total of 265 drilling rigs in the state only 164 or 62 per cent are currently operating.

Comparison to U. S. . . . The drilling contractors' contribution to drilling costs can be significant since they drill approximately 93 per cent of all wells drilled in the United States. The exact figure for California is not available, but it is only slightly less than this national average.

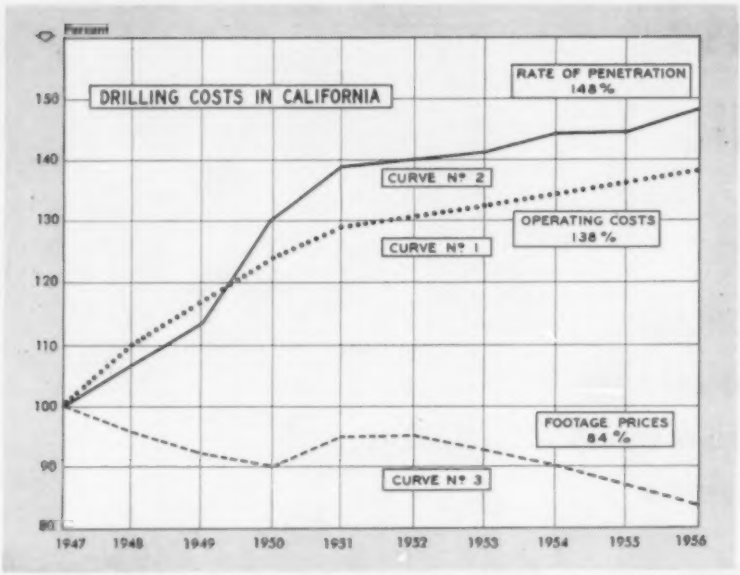
In 1956, 58,300 total wells were drilled in the United States and 2,374 of these were drilled in California, or approximately 4 per cent. The total footage drilled was 234,000,000 nationally, as compared to 11,000,000 in California, or approximately 5 per cent. This larger percentage of total footage is due to the fact that the average depth of the California wells was 4,750 ft. against a national average of 4,020 ft. The fact that the California wells averaged 18 per cent greater depth partially explains the fact that our average penetration per day was somewhat below the average for the entire country.

Many other factors such as more difficult formations, more directional drilling, and longer completion work, all combine to explain why the average footage drilled per operating day in California in 1956 was 166 ft. while the average for all United States wells was 226 ft. per day. One further comparison of interest is the fact that in 1956 out of a total average of 2,846 rigs running in the country, 187 or 6.6 per cent of these were operating in California.

Cost breakdown . . . When we come to take a closer look at what has happened to the cost of operating a California drilling rig in the last 10 years we must of necessity confine ourselves to a rig of one size—this because of the great variation in costs between the lightest rigs of 2,500-ft. rating and a heavy rig capable of drilling to 25,000 ft. For this purpose, I have assumed a usual California 10,000-ft. rig, equipped with a mast, complete hydraulic blowout equipment, 12,000 ft. of drill pipe, and two sizes of drill collars. Because certain costs, such as moving expense, fuel, mud, and bits vary so widely from well to well, I have also assumed a day-work job where such costs are paid by the operator.

Fig. 1 graphically illustrates the change in operating costs per day from 1947 to 1956. Again, because it is often very easy to get lost in a maze of figures, I have tried to make this chart as simple as possible. Labor includes all labor except office help and management. The equipment classification includes all capital items, such as the rig itself, the drill string, mast, and all accessory equipment. This is the item which some contractors, in periods of low rig activity and low prices frequently fail to include as a just cost. By so doing, they are

Original presentation was at West Coast district A.P.I. meeting, production division, under the title, "Drilling Costs in California."



TEN-YEAR TREND of operating costs, rate of penetration, and footage prices. **Fig. 2.**

only working on "borrowed time" or perhaps more accurately on "borrowed money." The item of supplies includes everything purchased and "used up" by the contractors—wire lines, pump parts, lubricants, and repairs to the equipment. The final classification of overhead includes all office expense, legal fees, and management costs. It also includes a small allocation of dollars and time spent in our A.A.O.D.C. activities, in an effort to improve our service to the oil industry.

It is interesting to note that although the daily cost of operating a 10,000-ft. rig has increased to 142 per cent in 10 years, the ratio of increase in each of the four items has remained constant. Also, in comparing these figures for California with the data for all wells drilled in the country, the ratio of increase has been very similar, California showing an increase to 142 per cent in 10 years and the national average increasing to approximately 138 per cent.

Very frankly, I see nothing that the contractor, any contractor, can do about the costs as shown on this chart. If he pays adequate wages, has good equipment, and keeps it in shape, it is going to cost about $1,128 per day to operate this type of rig. Perhaps an individual contractor can lower his depreciation or maintenance charges for a period of time, or perhaps he can forget the inherent hazards in footage contracts, but if he does it for long he will end up with a yard full of obsolete iron and an office full of creditors.

Cost trend . . . Fig. 2 gives the 10-year trend of operating costs, rate of penetration, and footage prices. The data are based upon national totals, but we have seen that California costs closely follow the national trends. Using the year 1947 as the base, Fig. 1 shows that operating costs have increased to 138 per cent in 10 years. However, during this same period the rate of penetration has increased even more to a percentage of 148 per cent as shown on curve 2 of Fig. 2.

This increased efficiency in the face of rising costs has resulted in curve 3 which shows that the cost per foot of hole has decreased to 84 per cent in 10 years. To express it another way, we are selling our product, a foot of hole, for 84 per cent while at the same time our costs of producing that product have gone up to 138 per cent. The answer is, of course, that we have produced more efficiently.

All contractors are proud of this record and all contractors realize that we must share our laurels with the drilling equipment manufacturers who have given us better tools with which to work. Improved and larger pumps, jet bits, engineered drilling strings, and a host of other improvements have made it possible for us to make more hole and charge less for this hole. For this, we say "thanks."

Future . . . Finally, recognizing the importance of drilling costs and seeing what has happened to such costs in the last 10 years—what of the future in California? As in the past, drilling problems in this state are going to be difficult and will require imagination and creative thinking. We are faced with deeper drilling, the many problems of drilling in residential areas, and perhaps most important from the standpoint of potential reserves, the problem of offshore drilling in deep water.

When you add problems you add costs and here I make a very sincere plea for closer cooperation between operator and contractor in order to keep these costs as low as possible. All too often the operator thinks only in terms of the lowest bid prices with no regard for quality of equipment, ability of drilling crews, or stability and reputation of the contracting company. By the same token, the contractors all too often are unrealistic in their bidding and encourage this cut-rate attitude of the operators. Our mutual problems can best be solved by better understanding and better interchange of ideas.

The drilling contractor is a specialist and should be consulted during the planning stages of any drilling program. The problems of hole deviation, the mud programs, and the type of equipment required, are all problems where the experience of the contractor is needed and should be used. His ideas could well lead to a reduction in drilling costs.

The contractor should, in turn, present his ideas of the value of a standardized drilling contract, the reduction in costs when allowed to operate on a continuous drilling program, and the ever-present problem of keeping competent drilling crews together. This adds up to one thing—improved relations between operator and contractor. We are on the same side of the fence and have the common goal of lower drilling costs for California. Let's work at it!

Drilling costs in California have pretty well kept pace with those in the rest of the country. But the future is not so rosy. Some of the problems lie in deeper wells, residential drilling, and offshore drilling, as pointed out in the discussion which starts on the facing page.

What It Costs to Drill Wells in California

Part 2 — By John J. LaBouff

Signal Oil & Gas Co.

A RECENT publication[1] listed a collection of cost data which indicated that drilling costs, per foot, in California were higher than those of every other state save one. These data showed that drilling costs here in California were nearly 5 dollars more a foot than those of the Rocky Mountain district, and over 6 dollars more per foot than those in the Mid-Continent. The normal reactions of California operators were lifted eyebrows and loud "how comes?".

The first portion of this discussion, presenting the contractor's considerations of the cost problem, has already given some of the answers to "how come?". Higher wage scales, cost of materials and various governmental regulations take their toll in dollars. This portion of the discussion, presenting the operator's viewpoint of the cost problem, will also try to answer some of the "how comes." In addition, it will attempt to point out just how well California operators have done, costwise, during the past 10 years, and give a quick look at what is in store for the future.

For the most part, this paper will ignore the dollars-and-cents aspects of the cost problem because everyone concerned certainly knows how much a string of 7-in. casing or a sack of quebracho costs these days. Actually, this whole subject falls more readily in the realm of the economist since a careful look at the over-all price structure shows the inflated value of the dollar to be primarily responsible for what the industry has chosen to call "increased drilling costs." Recent articles[2,3] showed that, by applying the 1950 dollar value to present costs, we are actually drilling some wells at a lower cost now.

Why Costs Are Higher

The figures showing drilling costs to be higher in California than in other parts of the country do not tell the whole story. A little digging behind the scenes and reading between the lines produces the following reasons why the footage cost is lower in other areas:

1. In the Mid-Continent area alone nearly 10 times as many wells were drilled as in California and many of these were low-cost shallow producers and service wells.

2. There is more widespread use of low-cost cable-tool methods in some areas.

3. Special completion fluids are not required in many hard-rock areas.

4. Considerable savings have been realized by drilling rate and bit-life advantages of air drilling in some regions.

5. Research on new tools has been aimed primarily at Mid-Continent performance; examples: jet bits, chert bits, and turbodrills.

6. The Mid-Continent area has lower percentage of completed wells with the resulting savings in casing and rig time. (The data showing California's drilling costs to be higher also showed a 73 per cent completion record for California as compared to 65 per cent for the Mid-Continent.)

When these considerations are joined with those presented in the first portion of this paper it is not difficult to see why the average foot of hole drilled in Texas or Oklahoma is cheaper than the same foot drilled here in California.

Comparison of Well Costs

To make any significant comparison of well costs, it is necessary to use some parameter other than the dollar because of its ever-changing value. A percentage comparison between wells drilled 10 years ago and those just recently completed should indicate whether or not present drilling costs are out of line. By comparing the cost of such items as casing, mud, bits, cement, and electrical logs to the total cost of wells drilled in 1947 and in 1955-56, it should be possible to determine where large increases in unit costs, if any, have occurred. These factors are chosen for comparison because they are a part of the cost of every development well drilled. Other important charges such as coring, perforating, and formation testing have not been considered because of their varying degree of usage.

The data available show a fair picture of the past 10 years and a glimpse of what is to come. Table 1 shows the comparison, percentagewise, of the costs of mud, bits, casing, cement, and electrical-logging services for the 1947 and 1955-56 periods. There has been very little change for any of the items considered; practically none for electric logs and mud. The only changes of any consequence are for bits and casing.

The reduction in the percentage cost for bits may possibly be ex-

TABLE 1—WHAT'S BEEN HAPPENING TO COSTS

Ten-year comparison, depth range 4,000-6,000 ft.

Item—	Year	No. wells	Total well costs		Item cost	Per cent of total
Mud	1947	17	$631,714		$24,211	3.83
	1955-56	33	$1,693,590		$58,223	3.84
Bits	1947	17	$631,714		$41,189	6.53
	1955-56	11	$516,178		$21,045	4.08
Casing, cement, E-logs	1947	32	$1,693,714	Casing	($513,608	30.3
	1955-56	15	$948,974		($323,292	34.1
				Cement	($53,678	3.17
					($39,826	....
				E-logs	($36,166	2.13
					($19,329	2.04

Depth comparison, 1955-56

Item—	Depth, ft.	No. wells	Total well costs	Item cost	Per cent of total
Mud	4,000-6,000	33	$1,693,590	$58,223	3.84
	7,000-10,000	35	$4,500,660	$221,153	4.91
Bits	4,000-6,000	11	$516,178	$21,045	4.08
	7,000-10,000	3	$291,968	$29,825	10.2

plained by better mud programs and increased bit efficiency through better design. Since the cost of tubular goods amounts to nearly one-third of the total cost of a well, an increase in steel prices has a more noticeable effect on the percentage cost for these items. Fig. 1 depicts the above comparisons graphically.

Other factors . . . Since the figures of Table 1 show little percentage change in the amounts spent for the usual items required in drilling and completing wells, it can be assumed that the same is true for other tools and services, where applicable. That is, percentage costs of gun perforating today will be approximately the same as those of 1947 for perforated intervals of comparable length. There has been, however, a trend toward perforating much longer intervals during the past few years resulting in an increase in the cost of this type of completion.

Similarly, there have been other changes in drilling and completion programs over the past few years. Some operators have made considerable reductions in the amount of coring done in both development and exploratory wells. They have relied, instead, on ditch samplings and formation tests to evaluate possible pays. Such programs have made significant savings in rig-time costs.

An important change noted in Table 1 is the increase in the percentage costs of mud and bits for wells in the 7,000-10,000-ft. class. There is nothing new or startling in the fact that drilling costs increase exponentially with depth, as indicated here. The point is that here in California new production must, in part, come from deeper horizons not yet explored. As a result we are going to be faced with larger and larger per well expenditures from our exploration and development budgets.

TABLE 2—UNIT COST INCREASES SINCE 1947

	1947	1956	Per cent of 1947 cost
Average well costs (4,000-6,000-ft. range)	$37,200	$51,400	138
Average tubular goods costs, $/lb.	$0.075	$0.12	160
Average cost of barrel of clay mud (based on 72-lb. mud from yield tables)	$0.485	$0.945	195

Some items high . . . Comparison of some unit costs on a basis of 100 per cent for 1947 prices gives an interesting picture of today's drilling costs. Table 2 shows that well costs have not increased as rapidly as the unit costs of some of the items used in drilling and completing wells.

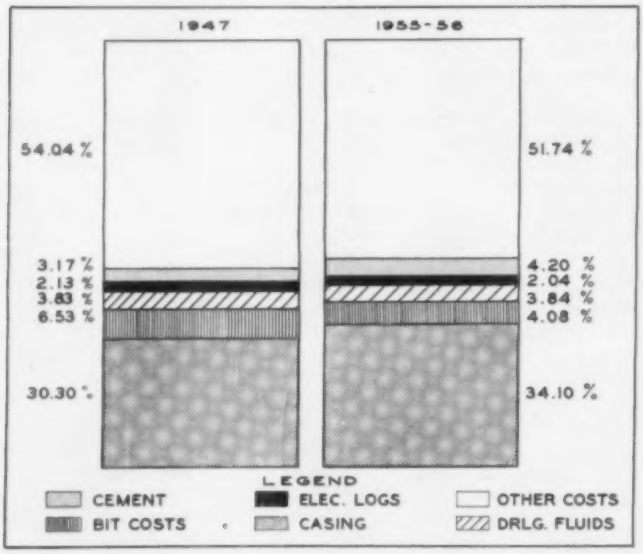
The cost of tubular goods was computed on out-of-stock prices for 8⅝-in., 32-lb. and 6⅝-in., 24-lb. casing and 2½-in., 6.5-lb. tubing, all of J-55 grade. The costs indicated for mud were based on a straight clay-water mixture. Had gels and mud chemicals been included, the per cent increase would have been somewhat lower since the cost of these items is approximately 140 per cent of 1947 prices.

The obvious conclusion drawn from these data is that we are making savings by drilling our wells faster, using smaller sizes of casing, and employing modern techniques and tools to get the job done quicker and cheaper.

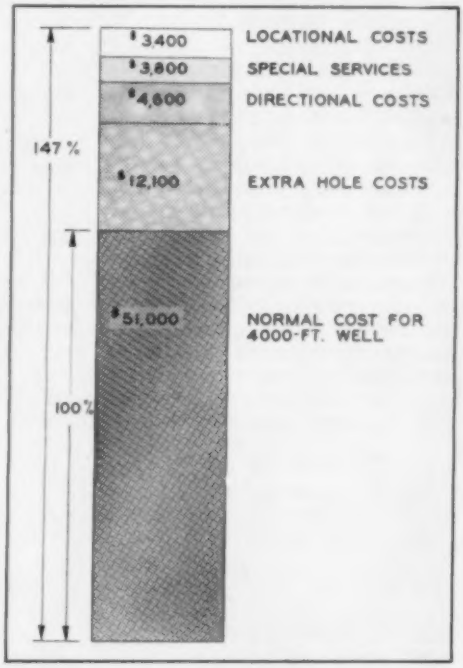
What Lies Ahead?

The tenor of this paper has so far been in the optimistic vein, giving the feeling that California operators have been doing a pretty good job of holding drilling costs down, and holding out a rosy view of the future. Unfortunately, all is not quite so rosy. The reason is that future development of reserves in California must, for the most part, come by way of: (1) drilling deeper wells to tap heretofore unknown reserves; (2) development of proved or semiproved reserves in residential areas; and (3) discovery and development of anticipated tidelands reserves from platforms and islands.

Deeper wells . . . Each of these conditions has its own peculiar problems to be overcome and the answers are generally expensive. Deep wells are apt to have temperature problems, hole troubles, and abnormal wear of casing



COSTS OF DRILLING—A comparison of the percentages of the various components which make up total cost, 1947 with 1955-56. Fig. 1.



ADDITIONAL COSTS imposed by drilling from restricted residential sites. Fig. 2.

and drill pipe. The deeper the holes go, the better are the chances of having high-pressure formations and lost-circulation zones open at the same time. This condition not only costs money to control; it also increases the ulcer count among tool pushers and drilling engineers.

Even if no serious problems arise, drilling a deep hole costs more through heavier grades of pipe, more conscientious mud control, reduced bit footage and considerable increase in trip time.

Residential drilling . . . Drilling in residential areas has been increasing rapidly during the past few years and along with it go higher drilling costs. In this instance, however, the higher costs are generally not of a direct drilling nature, for most of these wells could be drilled quite nominally under normal circumstances.

Here the restrictions imposed by regulations and codes and the normally incidental requirements grow to major proportions. Soundproofing, waste disposal, the added cost of directional work and down time caused by restrictions against certain operations during the night add a big part to the bill for these wells. In addition, the location must be fitted with expensive cellars to house the subterranean wellhead equipment and then landscaped to hide or beautify such equipment as must stay above ground level. The drilling equipment itself must sometimes be modified or rearranged to fit the small drill site.

Fig. 2 illustrates graphically the additional costs imposed by drilling from restricted residential drill sites. The values shown are based on a well drilled to 4,000 ft. vertical depth at an average drift angle of 45° after normal buildup. Total depth of such a well is approximately 5,300 ft. and requires about 25 days for completion. Wells drilled at lesser or greater drift angles will have proportionately lesser or greater costs.

This illustration shows an increase of nearly 50 per cent over the cost of drilling a straight hole from a normal location. Not included in this example are the costs of bottom-hole hydraulic pumping equipment and the pumps and storage facilities required for such a system. These are not strictly drilling costs and are used to some extent in normal field operations. They are, however, required for residential areas and must be considered in the overall cost program.

Also to be considered are the additional costs imposed on production operations in these areas. Constant supervision of wells, lines, and tanks is mandatory to prevent any leakage or spillage of oil. Well servicing is hampered by limited space and local regulations, and all tools, spare tubing, and supplies must be hauled to and from the well sites because of the lack of storage facilities.

While on the subject of residential drilling it might be well to add another thought even though it has no immediate relation to drilling costs. For many years the general public has had quite understandably strong objections against drilling operations anywhere near residential sections. In recent years, however, the operators working in these areas have, by means of up-to-date techniques and equipment, done much to alleviate the situation. For the good of the industry as a whole it behooves each of us to do what we can in furthering these better relations with the public.

Offshore Drill Sites

Development of the tidelands from platforms and islands has in many respects the same problems as residential drilling. Here, too, the industry must overcome the public objections to drilling operations along the coast. This means expensive landscaping of filled islands or the development of ocean-floor wellhead equipment and gathering lines for wells drilled from barges.

In this type of operation, transportation and supply become major cost items since sufficient inventory of certain materials must be kept on hand to handle emergency needs. Weather conditions can cause expensive delays in drilling operations, and, as in residential drilling, the cost of waste disposal and directional drilling adds to the cost per well. Finally, the drill site itself whether it be a platform, barge, or filled island adds its share to the bill, and that is bound to be big.

The cost of an offshore drill site will, of course, depend on its size, type, and the depth of the water. A six-well, self-contained platform of the type used in drilling in the Gulf of Mexico, will cost approximately $750,000. A tender-type platform of the same size costs approximately $400,000. Daily operational costs for these types of drill sites are estimated at $5,000 and $8,500 per day, respectively, when operating some miles offshore, as in the gulf area. Such drill sites located nearer docking facilities would cost only slightly less to operate.

Filled-island drill site costs depend largely on the depth of the water in which they are located. As a result, the depth factor imposes certain economic limits on where such drill sites are feasible. A rough estimate of the cost of a filled island in 40 ft. of water is about $800,000 plus $10,000 per well location.

Summary

This paper has touched on a few of the factors involved in drilling costs over which the operator normally has some degree of control. The evidence shows that the industry has been doing a pretty fair job in the past and indications are that it must do as well, or better, in the future. The specialized types of drilling operations present an even greater challenge to try to lower unit costs. Much will depend on what is forthcoming from design boards and research laboratories and how well these new tools and materials are used.

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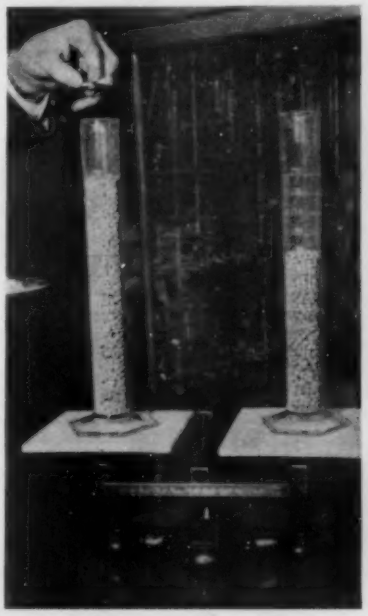
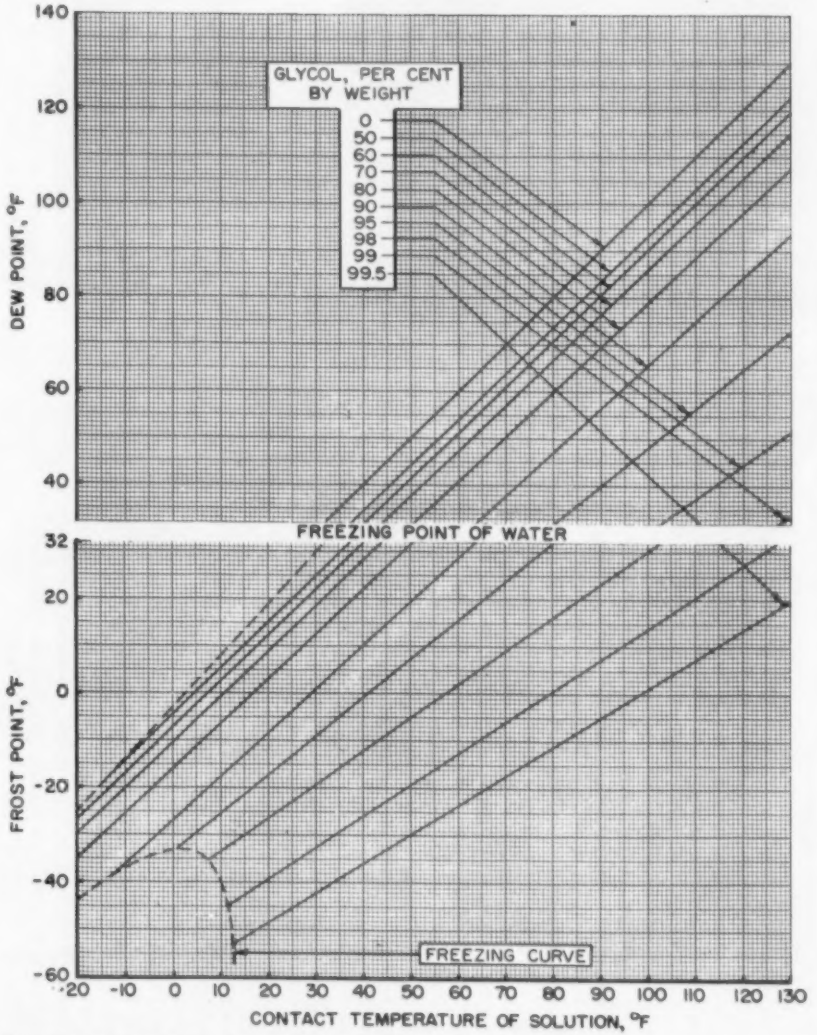
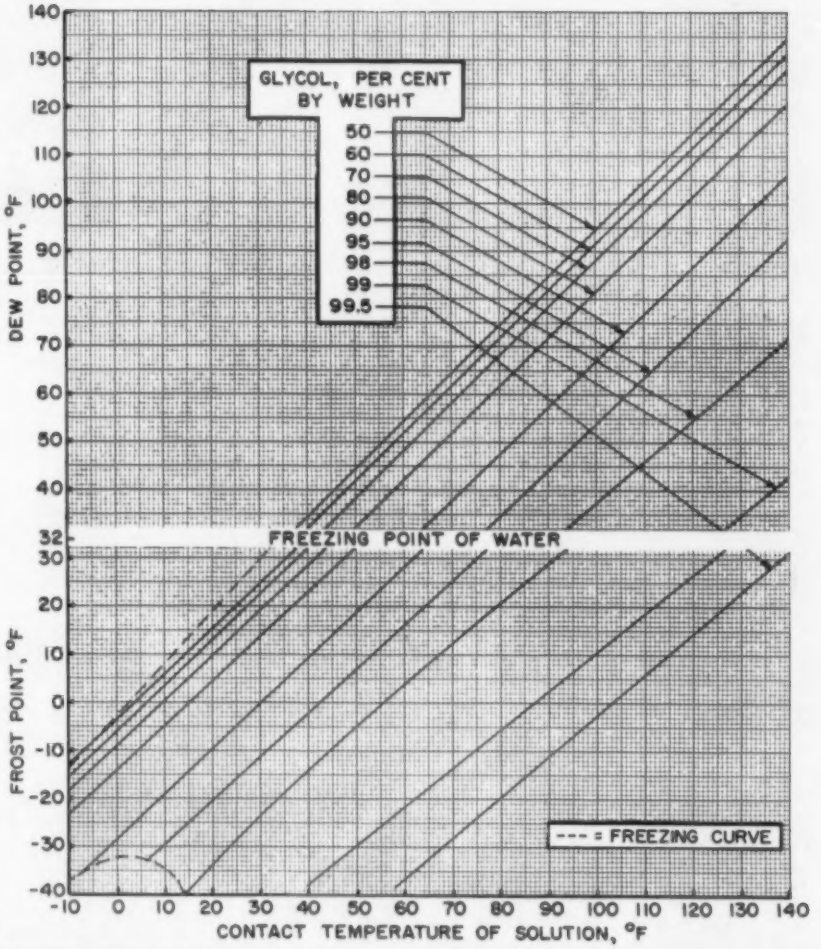


New Catalyst Shown

THE NEW low-bulk density catalyst, left, is American Cyanamid's new cobalt-molybdena desulfurization catalyst called AERO HDS-2. It is now being made at Cyanamid's new Fort Worth plant. Cyanamid claims for the new catalyst include good mechanical properties, especially high activity, greater sulfur and nitrogen removal, higher active metals content and superior porosity, as compared with other cobalt-molybdena types.



DIETHYLENE GLYCOL—Dew points of aqueous solutions at various contact temperatures, °F. Fig. 1.



TRIETHYLENE GLYCOL—Effects of aqueous solutions on dew points at various contact temperatures. Fig. 2.

Vacuum regenerating units prove value in

Dehydrating Natural Gas With Glycol

Here are operating data from 10 plants representing 55 plant-years' service using those units. Performance has been entirely satisfactory to date

By L. D. Polderman

THE GLYCOLS have been produced in commercially significant quantities for approximately 25 years and have been used to dehydrate natural gas for some 20 years. As far as we know, the first commercial-scale trial with diethylene glycol was made by Southern Counties Gas Co. at Huntington Beach, Calif., in the fall of 1936 in a plant designed to use glycerin.

While glycerin performed satisfactorily for a short time, it soon lost efficiency because of thermal decomposition.

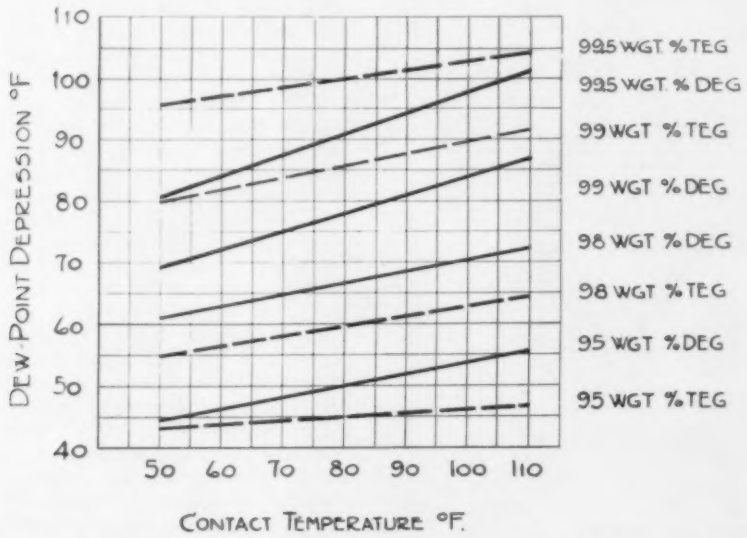
The first run with diethylene glycol lasted 25 days during which the average glycol concentration was 68 per cent and the average dew-point depression, 19° F. A paper by H. J. Carson[1] shows Northern Natural Gas Co. was installing dehydration facilities designed initially for use with diethylene glycol during this period. These plants were placed in service in 1937 and consistently provided dew-point depressions in the range of 40° to 50° F. with a reboiler temperature of approximately 330° F. The first plant to simultaneously desulfurize and dehydrate natural gas with a mixture of monoethanolamine and diethylene glycol was put in operation in November 1937 by Lone Star Gas Co., according to T. S. Bacon.[2]

Author is with Union Carbide Chemicals Co., New York. Presented at University of Oklahoma Gas Conditioning Conference at Norman, Okla.

By 1939, 16 plants using diethylene glycol were dehydrating natural gas.[3] Triethylene glycol was first used to dehydrate natural gas in 1949.[4] There are in operation today at least 5,000 glycol-type natural-gas-dehydration plants in the United States and Canada.

Using Glycols

The glycols are unusually hygroscopic materials and this is one of their properties that has led to their widespread use in many industries. The vapor pressure of water over glycol-water mixtures is lower than indicated by Raoult's law. For example, a 98 weight per cent triethylene glycol solution can provide a dew point of 38° with a contact temperature of 100° F., while Raoult's law indicates an expected dew point of 43° F. Water-vapor equilibrium data are, therefore, required to indicate the dew-point depressions obtainable in glycol systems and such data are given in Figs. 1, 2, and 3. The effect of pressure up to 2,000 psi. on the dew points of gas in equilibrium with aqueous glycol mixtures has been investigated in our laboratories as well as others[5] and found to be negligible. Plants operating in the 2,000 to 2,500-psi. range with which we are familiar are providing dew-point depressions in substantial agreement with the curves. A glycol unit treating natural gas at 3,200 psig. and producing a 70° F. dew-point depression compatible with the curves has been discussed by W. Swerdloff.[6]



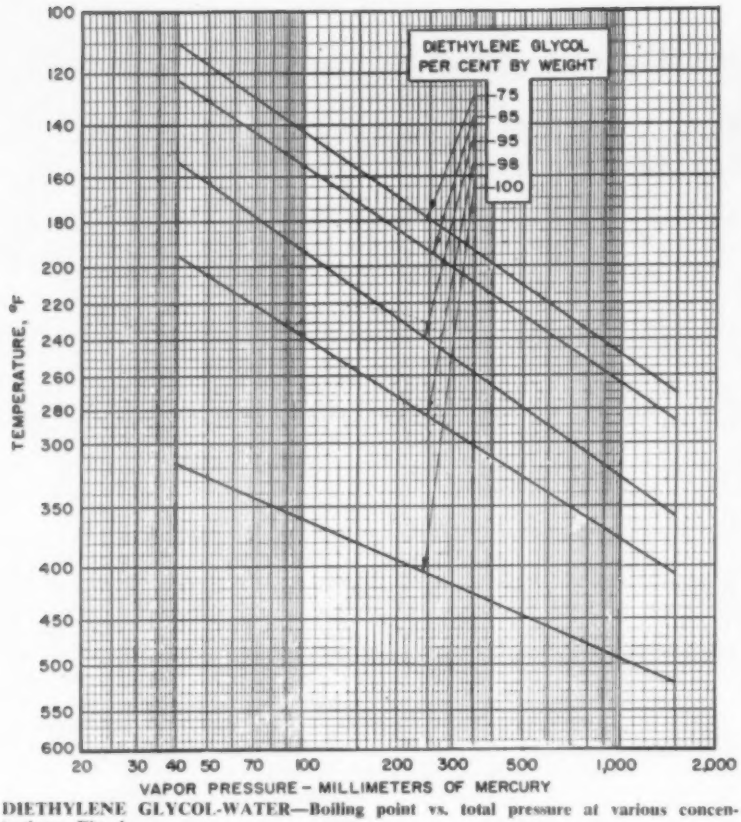
HYGROSCOPICITY—Comparison of hygroscopicity of diethylene and triethylene glycol. Fig. 3.

Dew-point depression . . . The curves represent equilibrium conditions and, therefore, show the maximum dew-point depression obtainable for a given glycol concentration.

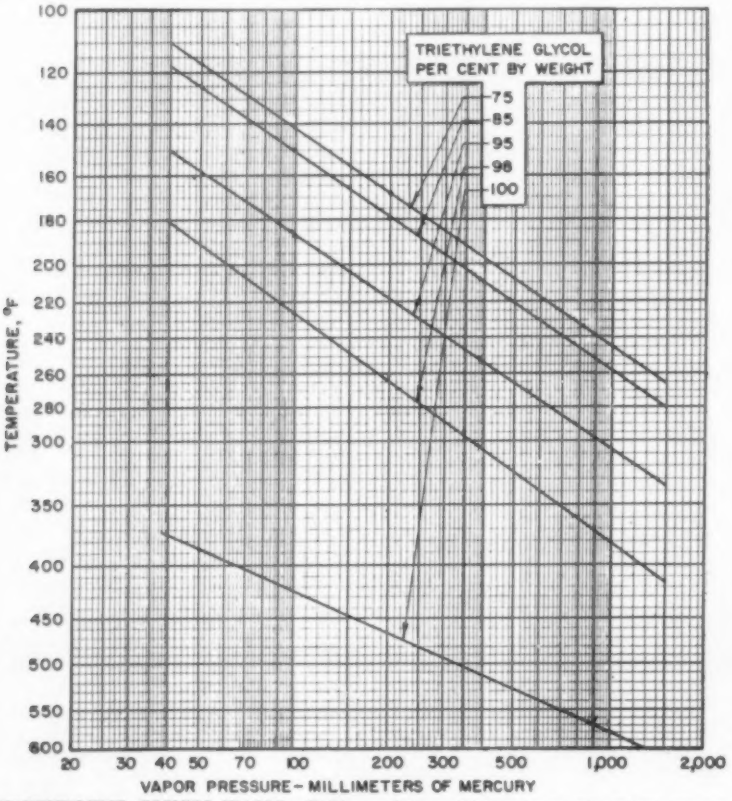
The dew-point depression secured in plant practice may be lower than shown on the charts if the glycol-circulation rate and contact efficiency between the glycol solution and gas stream in the absorber are inadequate. Contact temperatures below 50° to 60° F. may be detrimental, particularly in plants circulating low-water-content solutions. The glycol circulation rate required for maximum dew-point depression depends on the number of plates (or packing height) in the absorber, lower circulation rates being acceptable in plants having a greater number of plates.

Water Content of Lean Solution

In plants having adequate gas-to-liquid contact areas and glycol-circulation rates, the dew-point depression secured for a given contact temperature depends primarily upon the water content of the lean solution taken to the top of the absorber. It is standard practice in most plants to remove the water absorbed from the gas by boiling the solution at a pressure slightly



DIETHYLENE GLYCOL-WATER—Boiling point vs. total pressure at various concentrations. Fig. 4.



TRIETHYLENE GLYCOL-WATER—Boiling point vs. total pressure at various concentrations. Fig. 5.

above atmospheric. The thermal stability of the glycols and absorbed hydrocarbons limits the regeneration temperature in diethylene glycol systems to a maximum of 330°-350° F. and in the case of triethylene glycol to 350° to 375° or in some cases to 400° F.[7]

On Figs. 4 and 5 are plotted the boiling points of diethylene glycol and triethylene glycol water mixtures versus pressure showing that it is possible to secure lean solutions containing 1 or 2 per cent water at reasonable temperatures and vacuums. Regeneration at 200 mm. Hg absolute pressure rather than 760 mm. reduces the boiling point of a glycol-water solution approximately 100° F.

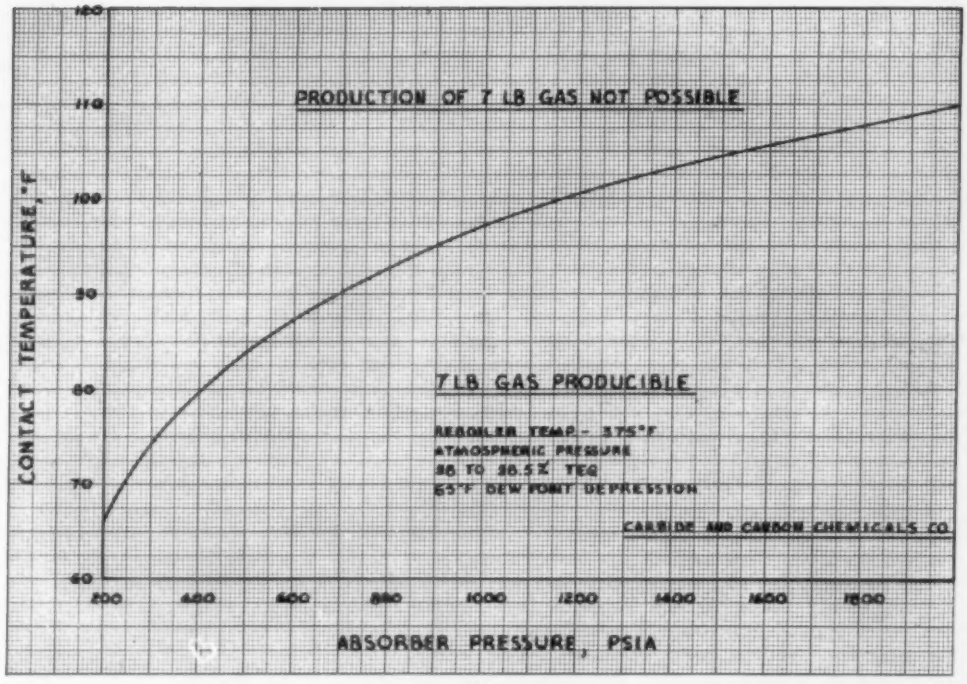
Fig. 4 indicates that with diethylene glycol at 760 mm., a maximum concentration of 96.5 per cent can be obtained at a temperature of 330° F. and at 350° F., 97.5 per cent.

Fig. 3 indicates that with such a diethylene glycol solution, dew-point depressions in the range of 50° to 65° are obtainable. With triethylene glycol at 760-mm. pressure and 350°-375° F., 98 to 98.5 weight per cent lean solutions are obtained which provide dew-point depressions in the 60° to 75° F. range.

Guarantees . . . Several equipment manufacturers today guarantee a 65° depression or 7-lb. gas whichever is first reached with a standard triethylene glycol plant and at least one company will guarantee a 75° depression for a nominal extra charge. The standard-type glycol dehydration plants discussed above are, in general, capable of producing 7-lb. or better gas when the inlet-gas temperature is not above the range of 70° to 90° F. and the pressure not below 500 psi. Many standard-type glycol units consistently provide an outlet gas with water contents in the 4 to 7-lb. per M.M.s.c.f. range under average treating conditions found in the field.

Fig. 6 shows the treating conditions under which 7-lb. gas can be produced based on the 65° F. dew-point depression guaranteed by at least three equipment manufacturers.

In a paper presented last year,[8] we stated that some glycol plants have consistently provided dew-point depressions in the 80°-100° F. range. These plants are able to secure unusually low-water-content solutions by regenerating the rich glycol solution under vacuum. Vacuum or some other unusual method of regeneration, such as gas stripping, azeotropic or extractive distillation, is required to secure ultralow-water-content solutions without the use of excessively high temperatures. Three vacuum-re-



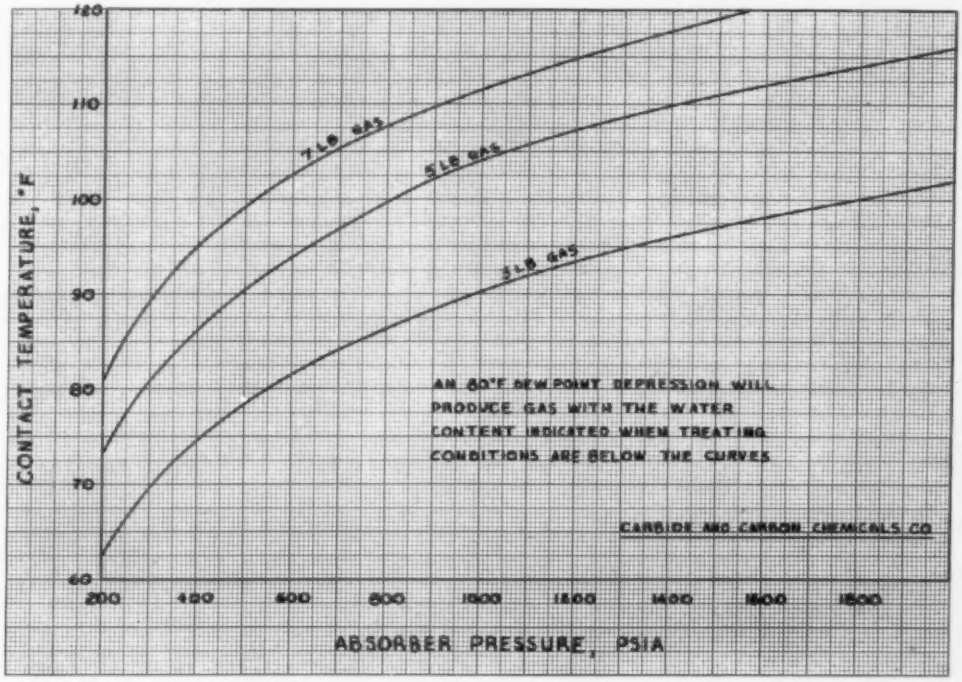
GUARANTEE—This shows conditions under which 7-lb. gas can be produced based on the 65° F. dew-point depression guaranteed by at least three equipment manufacturers. Fig. 6.

generated plants were briefly described in the literature several years ago.[9 10 11]

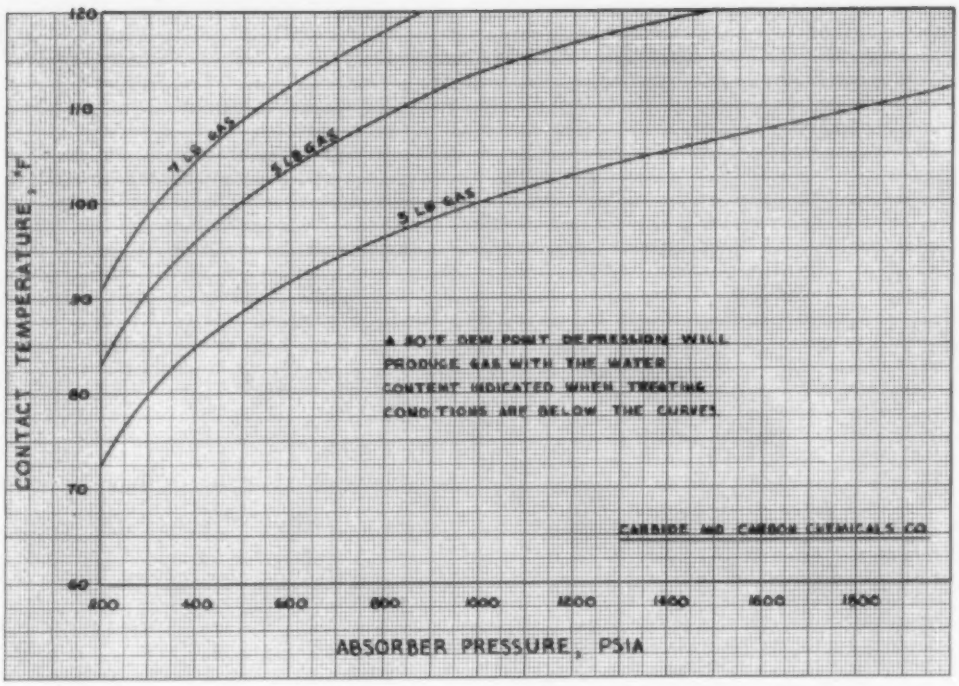
Vacuum Regeneration

There are some dozen plants using vacuum-regeneration systems today in the United States and Canada. These plants differ from the standard type of glycol system in that the still overhead is generally condensed and the regeneration system operated under a vacuum produced by a steam-jet exhauster or vacuum pump connected to the condensate receiver. A reflux pump is also generally required.

In Table 1 are tabulated operating data from 10 plants representing 55 plant-years service. Plants 1 through 8 inclusive follow oil-absorption systems, Plant 9 handles oil-field sepa-



DEW-POINT DEPRESSION of 80° F. is obtained under these conditions for 3-lb., 5-lb., and 7-lb. gas. Fig. 7.

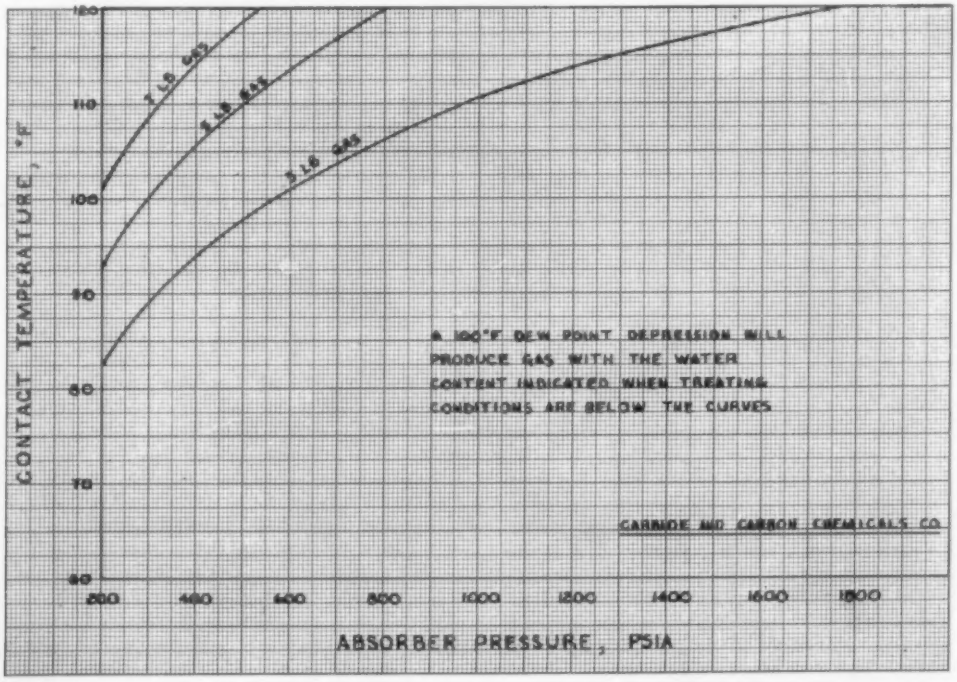


DEW-POINT DEPRESSION of 90° F. results under these conditions for 3-lb., 5-lb., and 7-lb. gas. Fig. 8.

rator gas, and Plant 10, recirculated hydrogen from a Platformer.

Plant 1 has eight absorbers handling two separate gas streams at 800 and 900-psig. pressure respectively. The inlet glycol temperature is held above the gas temperature to reduce hydrocarbon absorption. Despite this precaution 100 to 300 gal. per day of absorption oil are decanted from the glycol solution. The steam jets require 2,000 lb. per hour of 200-psig. steam. The plant people report that the system has operated without difficulty and provided dew-point depressions in the range of 80° to 90° F., which are satisfactory.

Plant 2 has two absorbers and is operating at 110 per cent of design capacity. The steam jets consume 250 lb. per hour of 250-psig. steam. The



DEW-POINT DEPRESSION of 100° F. is obtained under these conditions for 3-lb., 5-lb., and 7-lb. gas. Fig. 9.

TABLE 1—SUMMARY ON VACUUM DEHYDRATION PLANTS USING VACUUM REGENERATION

Item—	Plant identification— 1	2	3	4	5	6	7	8	9	10
1. Initial operation date	[1]1949	1950	1954	1951	1950	1950	1950	1949	1950	1953
2. Maximum gas flow rate, M.M.s.c.f.d.	450	105	70	104	42	30	55	73.5	25	130
3. Treating pressure, psig.	800-900	835	370	635	650	850	750	720	540	450
4. Service	Nat. gas	Nat. gas	Nat. gas	Nat. gas	Nat. gas	Nat. gas	Nat. gas	Nat. gas	Oil field gas[6]	H_2
5. Gas temperature—inlet, °F.	93	[3]70, 90	64	52	80	100	72	84	45	82
6. Gas temperature—outlet, °F.	93	[3]70, 90	70	61	80	90	82	86	47	82
7. Number of trays in absorber	4 to 6	8	6	6	8	10	4	7	8	5
8. Dew-point outlet gas, °F.	+9	[3]−15,−10	[9]+2	<+15	+8	+11	+21	+9	<−30	....
9. Dew-point depression, °F.	84	[3]85, 100	68	>46	72	79	61	77	>75	....
10. H_2O content outlet gas, lb./M.M.s.c.f.	3.3	1.1	4.3	<5.0	3.7	3.4	4.7	3.4	<1	....
11. Glycol-circulation rate, g.p.m.	42	18.8	11.2	10	4.8	17	15	15.6	10	11.7
12. Glycol circulation rate, gal. glycol/lb. H_2O removed	2.6	5.0	5.6	8.6	3.7	12.3	11.5	6.5	....	2
13. T °F. glycol to absorbers	95	[3]90, 90	88	116	68	80	113	94	45	80
14. Reboiler pressure, mm. Hg	150	175	252	250	50	200	465	385	225	400
15. Reboiler T, °F.	245	270	273	288	240	260	320	290	305	310
16. Vacuum system	Steam jet	Steam jet	Steam jet	Steam jet	Steam jet	Steam jet	Pump	Steam jet	Steam jet	Steam jet
17. Glycol in use	TEG	DEG	DEG	DEG	DEG	DEG	DEG	DEG	DEG	DEG
18. Weight per cent H_2O—rich glycol	3.3	2.8	4.4	....	....	....	2.8	3.5	....	....
19. Weight per cent H_2O—lean glycol	1.3	1.3	2.4	....	....	....	2.2	2.2	0.7	2.2
20. Theoretical H_2O content of lean glycol (Items 14 and 15)	2.1	1.9	2.8	1.8	1.0	3.0	2.1	3.0	1.1	2.0
21. Weight per cent hydrocarbon oil content of glycol	5.0	3.0	0.5	....	....	....	....	0.1	....	....
22. Theoretical dew-point depression, °F. (Items 19 or 20)	80	72	58	61	80	60	63	65	75	63
23. Glycol loss—lb./M.M.s.c.f.	[2]0.785	[4]0.35	0.21	[7]0.35	[5]0.9	....	[5]1.0	0.28	[5]0.5	0.48

1. Data given are average values for past 2 years (1955-1956. 2. Average for 1956. 3. Dual figures represent conditions after and before the addition of refrigeration equipment to the preceding oil absorption system. 4. Average since plant startup. 5. 50 per cent of loss is known to be in still overhead. No reflux provided. 6. Plant handles a mixture of oil field gas and condensate. Data apply to top section only of four-section contactor. 7. Glycol also used for injection. Figure is estimated loss in dehydration section only. 8. Plant operating at 177 per cent of design capacity. 9. Calculated from measured dew point of +12° F. at 660 psig.

plant operation has been satisfactory and 85° to 100° F. dew-point depressions secured. In both Plants 1 and 2, it should be noted that the actual water contents of the lean solutions are significantly lower than theory dictates, presumably because of the extra stripping provided by the absorbed gaseous and liquid hydrocarbons.

Plants 3, 5, 6, and 8 are located in areas requiring 9-lb. gas and none of the dehydration systems, therefore, are operated at maximum efficiency. While the present dew point in Plant 3 is +2° F., we are advised that dew points of —10° F. have been obtained during performance tests. Dew-point depressions of 68° to 80° have, therefore, been realized.

Plant 4 must produce 7-lb. gas which has been easily accomplished and data indicative of maximum performance are not available. In Plant 5, the gas rate being handled exceeds design by 77 per cent.

Plant 6 is not now operating as a vacuum plant as satisfactory dew points are secured with atmospheric-pressure regeneration. The plant was designed to handle 72 M.M.s.c.f.d. and when operated at this capacity, required 230 lb. per hour of steam at 250-psi. pressure for the steam jets. Data taken during vacuum operation showed depressions of 80° F.

Plant 8 has operated without difficulty and provides depressions in the range of 75° to 85° F. No effort has been made to secure lower dew points, present performance being satisfactory.

In Plant 9, the gas is dried in stages by diethylene glycol with interstage dehydrated gas used for drying the condensate. The absorber is divided into four sections: the first five trays drying gas, the second five trays drying condensate by means of the dehydrated gas and the two top sections redrying the gas with a gas cooler between the top sections. A field dehydrator is also supplied from the vacuum system. It is difficult to distribute the total glycol loss among the several dehydration systems.

The majority of the information in Table 1 is self explanatory. Items 18, 19, and 21 are from the laboratory analyses while the figures under Item 20 were obtained from Figs. 4 and 5, using the regeneration temperature and pressures given under Items 14 and 15. The theoretical dew-point depressions, Item 22, were obtained from Figs. 1 and 2 using the gas outlet temperature as the abscissa and the actual water content of the lean solution (Item 19), or in the cases where these data were not available, the theoretical lean solution water content (Item 20).

Comparison of plant dew-point depression data with calculated or theoretical values is sometimes difficult, particularly when the temperature of the gas leaving the absorber is significantly different from the temperature of the lean glycol entering the absorber. The glycol temperature is intentionally held 10° F. above the gas inlet temperature to minimize hydrocarbon absorption in many plants and in others the lean glycol temperature may be even higher for a variety of reasons. It is necessary to know the contact or equiiibrium temperature on the top plate to accurately estimate the outlet gas dew point. When the glycol inlet temperature is below or not more than 10° to 20° F. above the gas outlet temperature, good agreement between the actual and theoretical dew points shown on Figs. 1 and 2 will generally be found in properly operating plants. In Plants 1, 3, 5, and probably 9, for example, the estimated dew points are within 10° of those actually obtained.

As some gas and often also liquid hydrocarbons are dissolved in the rich glycol leaving the absorber, Figs. 4 and 5 should provide a conservative figure for the water content of the lean solution as they aid in the removal of water by contributing their partial pressure in the regeneration system. Data from Plants 1, 2, 3, 8, and 9 appear to confirm this.

Satisfactory Operation

In summary, discussions with personnel responsible for the operation and performance of the several vacuum plants indicate satisfaction with the systems.

• In the case of Plant 7, some difficulty with air leakage into the vacuum system has been experienced and a reflux pump would probably be helpful in reducing glycol losses. The 100 to 300 gal. per day of entrained absorption oil entering Plant 1 causes mechanical problems when the water content of the glycol is further reduced.

• The dew-point depressions being secured in all plants are adequate and if desired, could be increased with the possible exception of Plant 9 where a dew point lower than —30° F. is now produced.

• Glycol losses should be in the range of 0.2 to 0.5 lb. per M.M.s.c.f. of gas processed. We interpret the foregoing data and plant histories to indicate that dew-point depressions in the range of 80°-100° F. are realistic and generally obtainable without undue difficulties or close supervision in glycol plants utilizing vacuum regeneration.

It should be mentioned that dew-point depressions in the range of 70° to 80° F. are being obtained in several plants regenerating at atmospheric pressure by the introduction of stripping gas into the reboiler.

The use of Charts 1, 2, 3, 4, and 5 generally indicate conservative dew-point depressions as compared with those provided in commercial practice.[6]

Charts 7, 8, and 9 illustrate treating conditions required to obtain 3, 5 and 7-lb. gas with 80°, 90° and 100° F. depressions of the dew point below the outlet-gas temperature. It should be noted that 3-lb. gas can be produced at contact temperatures below 80° F. and pressures of 600 psia. or higher with 80° depressions.

Acknowledgment

We wish to thank the several plant owners for permission to publish the data and their efforts in reviewing the paper. The assistance of D. K. Wonder in preparing the paper is also gratefully acknowledged.

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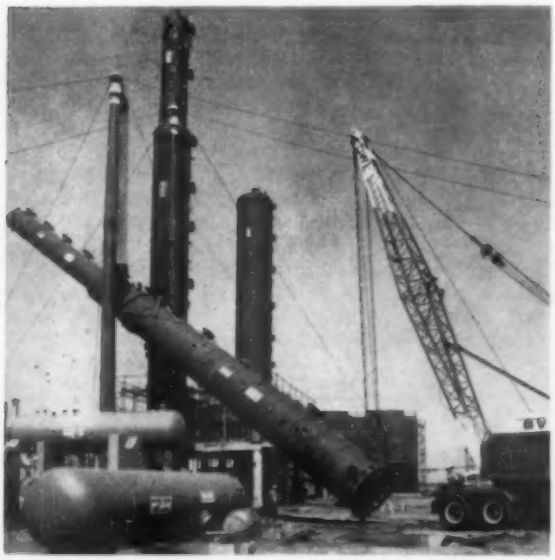


FRACTIONATOR TRAIN for the cat reformer includes stripper, fractionator, and stabilizer.

LARGE SPHERICAL REACTOR is one of three to be installed as part of the reforming unit.

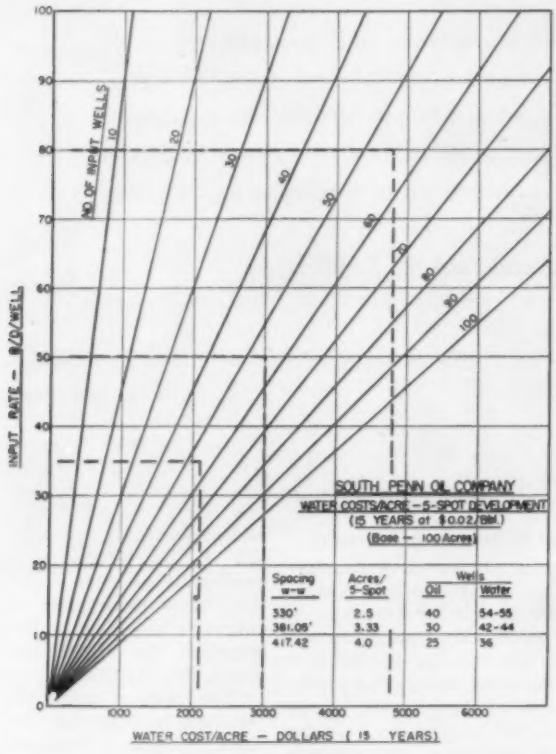
G. P.'s Torrance Plant Will Boost Reforming Capacity

A NEW catalytic reformer (Sovaformer) will soon go on stream at General Petroleum Corp.'s Torrance, Calif., refinery. The unit will be rated at 12,000 bbl. of naphtha feed per day. The refinery's catalytic reforming capacity will jump to 28,000 bbl. per day when this new facility goes on stream. A 16,000-bbl. Thermofor catalytic reforming unit is already in operation.

The 125,000-bbl. Torrance plant is well equipped to make today's high-octane motor fuels. Other catalytic processing facilities include a 55,000-bbl. T.C.C. unit and a 3,700-bbl. HF alkylation unit.

The high fractionator train for the new reformer (left photograph) includes a stripper 110 ft. high, a 100-ft. fractionator, and a 130-ft. stabilizer. The stripper will remove impurities from the feed, with the contaminants being taken off at the top of the tower. The fractionator will also be used in feed preparation, to provide naphtha of the proper boiling range. The stabilizer will be used to separate butane and lighter components from the finished reformate.

The large spherical reactor in the right photograph is one of three to be installed as part of the unit. Each reactor is about 20 ft. high and weighs about 100,000 lb. These vessels will be set on roller bearings.



WATER costs per acre. Fig. 1.

Calculating Water-Flood Costs

These charts provide the answer

THESE convenient charts provide a rapid method for finding the cost of water for flooding an oil reservoir. Results are in dollars per acre and in cents per barrel of oil produced.

The engineering department of South Penn Oil Co. prepared the charts to show the relation between water input rates and water costs. Basic assumptions are that the water will cost 2 cents per barrel, and the time will be 15 years. For other bases, the costs from the charts may be converted to the appropriate values by simple multiplication by the ratio of the new base to the original.

To use the charts, first start with Fig. 1. Enter the chart on the left with barrels per day per injection well. Read over to the number of wells per 100 acres then down to the cost per acre for a 15-year period.

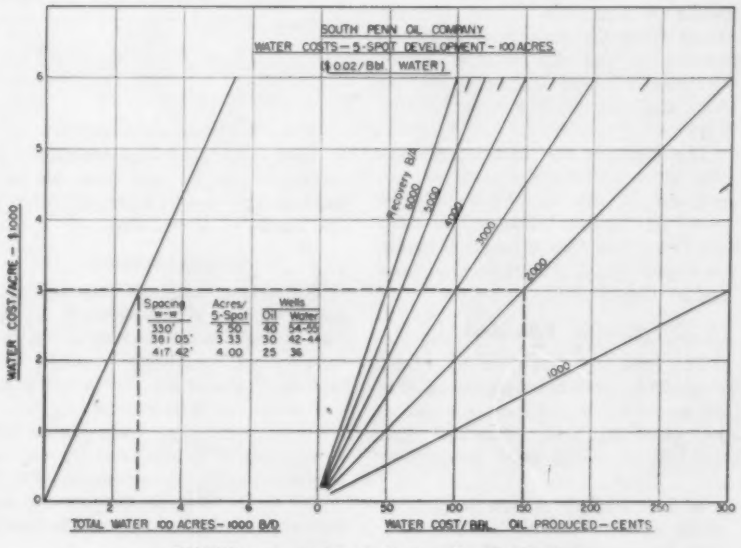
Using Fig. 2 and the water cost per acre enter the chart on the left and read over to the first diagonal line and down to the total water injected daily per 100 acres. For water cost per barrel of oil, read over to the second set of diagonal lines to the expected oil recovery per acre and down to the cost.

For five-spot injection patterns, South Penn uses the following table to estimate the number of wells per 100 acres:

Well spacing* (ft.)	Acres per five-spot	Wells — Oil	Wells — Water
330	2.50	40	54-55
381	3.33	30	42-44
417	4.00	25	36

*Between oil and oil wells or water and water wells.

The lines on the charts show sample calculations. For example, assume 100 acres is to be developed with 330-ft. spacing between wells. From the table, the number of injection wells would be 55. If the input rate is 50 bbl. per day per well, the water cost per acre found by Fig. 1 is $3,000. From Fig. 2, the total daily water input is found to be 2,750 bbl. For an expected recovery of 6,000 bbl. per acre, the water would cost 50 cents per barrel of oil. If recovery were only 2,000 bbl. per acre, the cost would be $1.50 per barrel of oil. If water cost 4 cents per barrel, these costs would be doubled. If the flood lasted only 5 years, costs would be a third of these.



WATER costs per barrel of oil produced. Fig. 2.

Pipeline-Flow Efficiency Testing

Part 1 discussed the test equipment and procedures which should be used to obtain valid experimental data for calculating pipeline-flow efficiency. In this article the equations required for calculating flow efficiency are presented and discussed and their use is illustrated in a sample calculation.

By R. F. Bukacek and R. T. Ellington

Institute of Gas Technology, Chicago

2. Efficiency Calculation

SINCE the flow efficiency of a pipeline is defined as the ratio of its measured gas flow to that calculated by use of a flow equation, these quantities should be evaluated from test data obtained by use of the procedures recommended in the previous article. These calculations must be made with considerable care.

Significant errors can be made unless the proper procedures are used to calculate several "average" gas properties, equivalent pipe lengths and diameters, and the effects of elevation change. The practical methods, presented in this paper, for determining each of these quantities are easily applied and insure the necessary accuracy.

The equations which should be used to calculate each of the quantities used in efficiency determination are given in convenient form in Table 1. The general flow equation is presented along with the modifications most widely used in the transmission industry; the Weymouth and Panhandle A equations. These are obtained from the general equation by substituting for the friction factor functions of pipe diameter, in one case, and Reynolds number in the other.

The methods for calculating flow rates from orifice-meter data are not included in the table but may be found in "Orifice Metering of Natural Gas," Gas Measurement Committee Report No. 3, American Gas Association (April 1955).

General Procedure

The field test data must be treated properly to obtain values of each of the terms to be used in determining the observed and calculated flow rates. Thus values must be obtained for:

- Effect of difference in elevation of the ends of the test section.
- Average flowing pressure.
- Average flowing temperature.
- Average pipe diameter.
- Effective pipe length.

Where more than one method can be used to evaluate one of these terms, each is presented along with the conditions under which it should be used.

Effect of Difference in Elevation

The forms of the flow equation presented in Equations 3-8 contain terms which correct for difference in elevation between the ends of the test section. In one case the correction is based on use of an average gas density for the test conditions and, in the second, on the assumption that the slope of the pipeline is constant over the test interval (Ferguson, Gas Age, 1936).

Since no assumptions are made regarding the pipeline configuration and only proper values for the average temperature, pressure, and compressibility factor of the gas are needed, the first method should be more popular. The closeness of approximation of the second method can be improved by dividing the test length into segments so short that each has essentially a constant slope. In most cases the two methods give results agreeing within a few tenths of 1 per cent.

Average Pressure

The average pressure may be computed by use of Equation 9 or 10. For pressure drops less than 0.2 per cent of the operating pressure, the former is satisfactory. For larger pressure drops the more accurate Equation 10 is recommended. Even greater accuracy could be obtained by use of pressure profile measurements, but it would be difficult to imagine a practical case in which this would be worth while.

Average Temperature

The average gas temperature may be computed as the arithmetic mean of end temperatures or as a weighted average based on temperatures obtained at a number of points along the test section. For cases in which the temperature change is less than 20° F., use of the arithmetic mean introduces less than 1 per cent error. For larger temperature changes it is advisable to obtain sufficient data to establish the temperature variation along the pipeline.

The average temperature may be obtained from the temperature profile data by plotting temperature versus distance, drawing a smooth curve through the data points, and dividing the total area under the curve by the total distance. This result may be approximated closely by applying the trapezoidal rule to the interval between each temperature data point. Thus for an interval in which T_0, T_1, T_2, T_3, are the temperatures obtained at the start of the test section and at the end of distances L_1, L_2, L_3, respectively, the average temperature is:

$$T_{avg} = \frac{[T_0 + T_1)/2]\ L_1 + [(T_1 + T_2)/2]\ L_2 + [(T_2 + T_3)/2]\ L_3 + \ldots}{L_1 + L_2 + L_3 + \ldots}$$

Where several sizes of pipe make up the tracer travel section, the average diameter of the section may be calculated from Equation 12. This equation gives a weighted average of the diameter squared since it is the effect of cross-sectional area which is determined.

For evaluation of the calculated flow rate, where several pipe sizes are involved, an equivalent length should be calculated which is based on a convenient diameter as in Equations 13-15. This form is obtained since the flow through each section in the series is the same and the sum of the pressure drops across the various sizes equals the pressure drop

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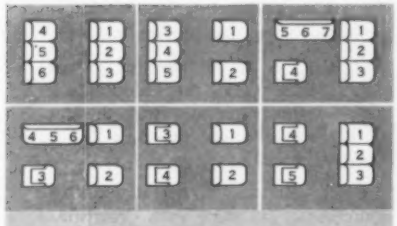

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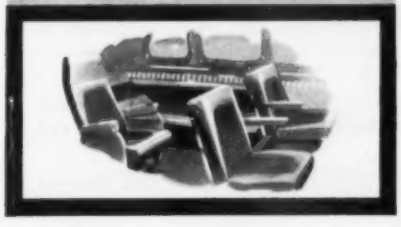

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TABLE 1—SUMMARY OF CALCULATION OF PIPELINE FLOW EFFICIENCY

QUANTITY	EQUATION	No.
Efficiency	$E = Q_{b,obs.} / Q_{b,calc.}$	1
$Q_{b,obs.}$ with tracer technique	$Q_b = \frac{41469\ LD^2\ P_{avg}\ T_b}{\theta\ P_b\ T_{avg}\ z_{avg}}$	2
$Q_{b,calc.}$	General: $Q_b = 38.77(T_b/P_b)\left[\frac{P_1^2-P_2^2-\frac{0.0375G(h_2-h_1)P_{avg}^2}{z_{avg}\ T_{avg}}}{G\ T_{avg}\ L\ z_{avg}\ f}\right]^{0.500} D^{5/2}$	3
	Panhandle A: $Q_b = 435.87(T_b/P_b)^{1.0788}\left[\frac{P_1^2-P_2^2-\frac{0.0375G(h_2-h_1)P_{avg}^2}{z_{avg}\ T_{avg}}}{G^{0.8539}\ T_{avg}\ L\ z_{avg}}\right]^{0.5394} D^{2.6182}$	4
	Weymouth: $Q_b = 433.49(T_b/P_b)\left[\frac{P_1^2-P_2^2-\frac{0.0375G(h_2-h_1)P_{avg}^2}{z_{avg}\ T_{avg}}}{G\ T_{avg}\ L\ z_{avg}}\right]^{0.5000} D^{8/3}$	5
	General: $Q_b = 38.77(T_b/P_b)\left[\frac{(P_1^2-P_2^2e^S)S}{G\ T_{avg}\ L\ z_{avg}\ f(e^S-1)}\right]^{0.500} D^{5/2}$	6
	Panhandle A: $Q_b = 435.87(T_b/P_b)^{1.0788}\left[\frac{(P_1^2-P_2^2e^S)S}{G^{0.8539}\ T_{avg}\ L\ z_{avg}(e^S-1)}\right]^{0.5394} D^{2.6182}$	7
	Weymouth: $Q_b = 433.49(T_b/P_b)\left[\frac{(P_1^2-P_2^2e^S)S}{G\ T_{avg}\ L\ z_{avg}(e^S-1)}\right]^{0.5000} D^{8/3}$	8
P_{avg}	$P_{avg} = (P_1 + P_2)/2$	9
	$P_{avg} = \frac{2}{3}(P_1^3 - P_2^3)/(P_1^2 - P_2^2)$	10
T_{avg}	$T_{avg} = (T_1 + T_2)/2$	11
D_{avg}^2	$D_{avg}^2 = \frac{L_1D_1^2+L_2D_2^2+L_3D_3^2+\ \ldots}{L_1+L_2+L_3+\ \ldots}$	12
L_e	General: $L_e = D_e^5/f_e\left[(L_1f_1/D_1^5)+(L_2f_2/D_2^5)+(L_3f_3/D_3^5)+\ \ldots\ \right]$	13
	Panhandle A: $L_e = D_e^{4.8539}\left[(L_1/D_1^{4.8539})+(L_2/D_2^{4.8539})+(L_3/D_3^{4.8539})+\ \ldots\ \right]$	14
	Weymouth: $L_e = D_e^{16/3}\left[(L_1/D_1^{16/3})+(L_2/D_2^{16/3})+(L_3/D_3^{16/3})+\ \ldots\ \right]$	15
e^S	$e^S = 1+S+(S^2/2)+(S^3/3!)+\ldots S^n/n!$	16

COMMENTS ON EQUATIONS

1. $Q_{b,obs.}$ is the measured gas flow rate; $Q_{b,calc.}$ is that from a flow equation.

2. This equation is used only when the tracer technique is employed.

3. In these equations the correlation for elevation change is based on average gas density.

4. In these equations the correction for elevation change is based on the assumption of constant pipeline slope.

9. Equation 9 is less accurate than Equation 10 but is applicable to small pressure drops.

11. Applicable to small temperature changes. For larger temperature changes a temperature profile must be used.

12. To be used in calculating $Q_{b,obs.}$ from tracer data where the tracer travel section is comprised of several sizes of pipe.

13. To be used in evaluating $Q_{b,calc.}$ where efficiency test section is comprised of several sizes of pipe.

16. This method of calculating e^S is accurate provided that sufficient terms are included. For S less than 0.05 only the first three terms are required.

SYMBOLS

D, in inches, internal diameter of pipeline section.

D_{avg}, in inches, average internal diameter used in calculating $Q_{b,obs.}$

D_e, in inches, equivalent diameter on which equivalent length is based.

D_1, D_2, D_3, in inches, diameters of the different pipe sizes comprising a pipeline section.

E, dimensionless, pipeline efficiency.

e, 2.718, base of natural logarithms.

f, dimensionless, friction factor.

f_e, dimensionless, friction factor for equivalent diameter D_e.

f_1, f_2, f_3, dimensionless, friction factors referring to pipe sections having diameters D_1, D_2, and D_3.

G, dimensionless, gas specific gravity relative to air.

h_1, h_2, in feet, elevations at inlet and outlet of pipeline section.

L, in miles, length of pipeline section.

L_e, in miles, equivalent length of pipeline section based on equivalent diameter D_e.

L_1, L_2, L_3, in miles, line lengths referring to pipe sections having diameters D_1, D_2, and D_3.

P_{avg}, in psia., average gas pressure in a pipeline section.

P_b, in psia., base pressure to which gas volume measurements are referred.

P_1, P_2, in psia., inlet and outlet gas pressures of a pipeline section.

$Q_{b,calc.}$, in cu. ft. per day at base conditions, gas flow rate calculated by use of a flow equation from the conditions prevailing at the time $Q_{b,obs.}$ is determined.

$Q_{b,obs.}$, in cu. ft. per day at base conditions, gas flow rate determined by orifice meter or tracer test.

S, $0.0375G\ (h_2 - h_1)/z_{avg}\ T_{avg}$.

T_{avg}, in °R., average gas temperature in a pipeline section.

T_b, in °R., base temperature to which gas volume measurements are referred.

T_1, T_2, in °R., gas temperatures at the inlet and outlet of a pipeline section.

z_{avg}, dimensionless, gas compressibility factor determined at P_{avg} and T_{avg}.

θ, in minutes, elapsed time between tracer injection and its detection.

Congrats and $25 to O. C. IRVINE, P. O. Box 1407, Shreveport, La., for this quip.

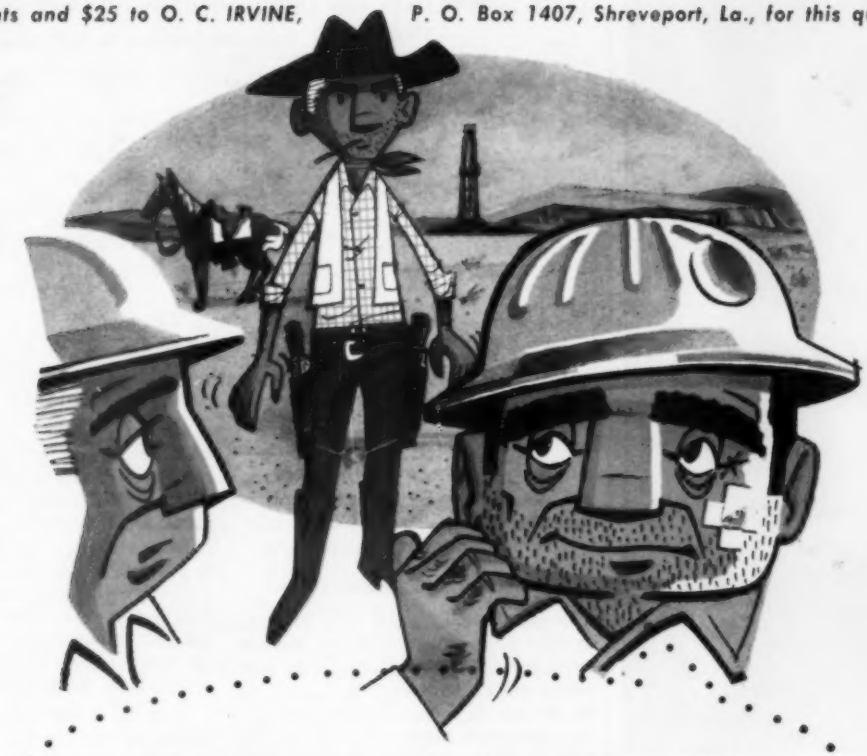

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TABLE 2—TEST DATA FOR LENGTH OF 30-IN. NOMINAL DIAMETER PIPE

Time	Valve No. 49	Valve No. 52	River tap	Benson
10:50 a.m.	829.7	....	....	708.0
11:00 a.m.	829.8	742.4	714.1	707.9
11:10 a.m.	829.8	742.3	714.2	707.8
11:20 a.m.	829.7	742.3	714.3	707.9
11:30 a.m.	829.6	742.3	....	707.8
11:40 a.m.	829.7	742.2	714.3	707.8
11:50 a.m.	829.6	....	....	....
Average pressure	829.7	742.3	714.2	707.9
Gas temperature, °F.	86.0	79.0	78.0	78.0
Atmospheric pressure, psia.	12.6	12.5	12.8	12.8
Elevation, feet	4,467.0	4,712.0	....	3,542.0
Mile post	407.5	433.84	445.99	447.03

Gas gravity = 0.645; $P_b = 14.73$; $T_b = 60 + 460 = 520°$ R.
Line diameter: 1.35 miles 29-in. i.d.; 39.53 miles 29.33-in. i.d.
Ammonia injected at valve No. 52 at 10:57′ 38″ a.m.
Ammonia detected at river tap at 11:40′ 04″ a.m.
0.50 miles of 29-in. i.d. pipe; 11.65 miles of 29.22-in. i.d. pipe.

over the whole test section. On substitution of the proper flow equation it is found that a power function is obtained which depends upon the original substitution for friction factor.

Sample Calculations

A sample calculation will be used to illustrate evaluation of the various terms for calculating $Q_{b,\,obs.}$ from ammonia tracer data and $Q_{b,\,calc.}$ from the Panhandle A equation. Representative ammonia tracer data for a section of 30-in. nominal diameter pipe are given in Table 2, and the calculation of the observed flow rate is summarized in Table 3. Determination of the calculated flow rate, by use of the flow equation and observed pressure drop, is shown in Table 4 by developing each term to the final substitution.

Summary

With pipeline efficiency defined by Equation 1, it is evident that pipeline efficiency is not measured relative to an absolute standard. As a result it is necessary to specify the manner of obtaining $Q_{b,\,calc.}$ in detail before it is possible to interpret the results of a pipeline efficiency test. For the test data given, the efficiency was 86.3 per cent; however, had the Weymouth equation been used, the efficiency would have been 105.6 per cent.

In some companies, $Q_{b,\,calc.}$ is obtained by use of the flow equations as given, except that the effect of elevation and/or the compressibility factor is omitted. If the effect of elevation is neglected, the efficiencies calculated in the example are 93.12 per cent based on the Panhandle A equation, and 113.3 per cent based on the Weymouth equation. If in addition the compressibility factor is omitted, the results are 99.7 per cent and 120.7 per cent. It should be clear than, that considerable care must be exercised

TABLE 3—CALCULATION OF ACTUAL FLOW RATE, $Q_{b,\,obs.}$, FROM AMMONIA TRACER TEST DATA

Quantity	Equation	Calculation
P_{avg}	9	$(P_1+P_2)/2 = 1/2 \times (742.3+12.5)+(714.2+12.8)=740.9$ psia.
P_{avg}	10	$\frac{2}{3}\frac{P_1^3 - P_2^3}{P_1^2 - P_2^2} = \frac{2}{3}\left[\frac{(754.8)^3 - (727.0)^3}{(754.8)^2 - (727.0)^2}\right] = 740.99$ psia.
T_{avg}	11	$(T_1+T_2)/2 = [(460+79) + (460+78)]/2 = 538.5°R$
D^2_{avg}	12	$\frac{L_1D_1^2+L_2D_2^2}{L_1 + L_2} = \frac{0.50(29.00)^2+11.65(29.33)^2}{12.15} = 859.5$
z_{avg}	*	$\frac{1}{F_{PV}^2} = \frac{1}{(1.0627)^2} = 0.8855$ (based on T_{avg} & P_{avg})
$Q_{b,obs.}$	2	$\frac{41469LD^2P_{avg}T_b}{\theta\, P_b\, T_{avg}\, z_{avg}} = \frac{41469x12.15x859.5x741.0x520}{42.433x14.73x538.5x0.8855}$ = 559,800,000 Cu. ft./day

* F_{PV} evaluated at P_{avg} and T_{avg} from "Supercompressibility Factors for Natural Gas" American Gas Association, June 1955.

TABLE 4—DETERMINATION OF CALCULATED FLOW RATE, $Q_{b,\,calc.}$ BASED ON PANHANDLE EQUATION

(Applied to pipeline section from Valve 49 to Benson)

Quantity	Equation	Calculation
P_{avg}	9	$\frac{P_1+P_2}{2} = [(829.7+12.6)+(707.9+12.8)]\ /2 = 781.5$ psia.
P_{avg}	10	$\frac{2}{3}\ \frac{P_1^3-P_2^3}{P_1^2-P_2^2} = \frac{2}{3}\ \left[\frac{(842.3)^3-(720.7)^3}{(842.3)^2-(720.7)^2}\right] = 783.1$ psia.
T_{avg}	11	$(T_1+T_2)/2 = [(460+86)+(460+78)]/2 = 542^{\circ}R$
Le	14	$D_e^{4.8539}\ (L_1/D_1^{4.8539}+L_2/D_2^{4.8539}$; let $D_e = D_1 = 29.33$
		$L_1 + L_2.(\frac{D_e}{D_2})^{4.8539} = 38.18 + 1.35(\frac{29.33}{29.00})^{4.8539}$
		$4.8539 \log (\frac{29.33}{29.00}) = 0.02385$ L_e=38.18+1.35
		(1.056) = 39.61
$G^{0.8539}$		$0.8539 \log 0.645 = (0.8539)\ (-.19044)$
		$= -0.162617$ $G^{0.8539} = 0.6877$
z_{avg}		$\frac{1}{P_{PV}} = \frac{1}{(1.0652)} = 0.8813$
S		$0.0375\ G\ (h_2-h_1)/z_{avg}\ T_{avg} =$
		$\frac{0.0375 \times 0.645 (3542-4467)}{0.8813 \times 542} = -0.04684$
$\frac{P_1^2-P_2^2-P_{avg}^2\ S}{G^{0.8539}\ z_{avg}\ T_{avg}\ L}$		$\frac{(842.3)^2 - (720.7)^2 + (783.1^2 \times 0.04684)}{0.6877 \times 0.8813 \times 542 \times 39.61} =$
		$\frac{218,800}{1301} = 16.82$
E^3	16	$1 + S + \frac{S^2}{2} = 1-0.04684 + \frac{(0.04684)^2}{2}$
		$= 0.95426$
$\frac{(P_1^2-P_2^2\ e^S)S}{G^{0.8539} z_{avg} T_{avg}\ L(e^S-1)}$		$\frac{[(842.3)^2-(720.7)^2(0.9543)]\ (-0.04684)}{0.6877 \times 0.8813 \times 542 \times 39.61\ (0.95426-1)} = 16.83$
$D^{2.6182}$		$2.6182 \log 29.33 = 2.6182 \times 1.46731 = 3.84171$
		$D^{2.6182} = 6945$
$(T_b/P_b)^{1.0788}$		$1.0788 \log \frac{520}{14.73} = 1.0788 \times 1.54778 = 1.66975$
		$(T_b/P_b)^{1.0788} = 46.75$
$\left[\frac{P_1^2-P_2^2-P_{avg}^2\ S}{G^{0.8539}\ T_{avg}\ L\ z_{avg}}\right]^{0.5394}$		$0.5394 \log 16.82 = 0.5394\ (1.225826)$
		$= 0.661211$
		antilog $0.661211 = 4.584$
$Q_{b,calc.}$	4	$435.87\ (T_b/P_b)^{1.0788}\ \frac{P_1^2-P_2^2-P_{avg}^2\ S}{G^{0.8539} T_{avg}\ L\ z_{avg}}^{0.5394}$
		$D^{2.6182} = 435.87 \times 46.75 \times 4.584 \times 6945 =$
		648,700,000 CF/HR

Calculation of Efficiency

Quantity	Equation	Calculation
E	1	$Q_{b,obs.}\ /Q_{b,calc.} = \frac{559\ 800\ 000}{648\ 700\ 000}$
		$= 0.8630$ (86.3%)

in comparing pipeline efficiencies and interpreting the results of efficiency tests.

The above discussion has presented methods which should be used to calculate various quantities used in evaluating flow efficiency to minimize errors. It is important that the test engineer be able to analyze each quantity used in flow-efficiency calculation to determine the accuracy achieved in measuring and calculating its value and the effect of each on the final result. Evaluation and analysis of errors will be taken up in the final article in this series.

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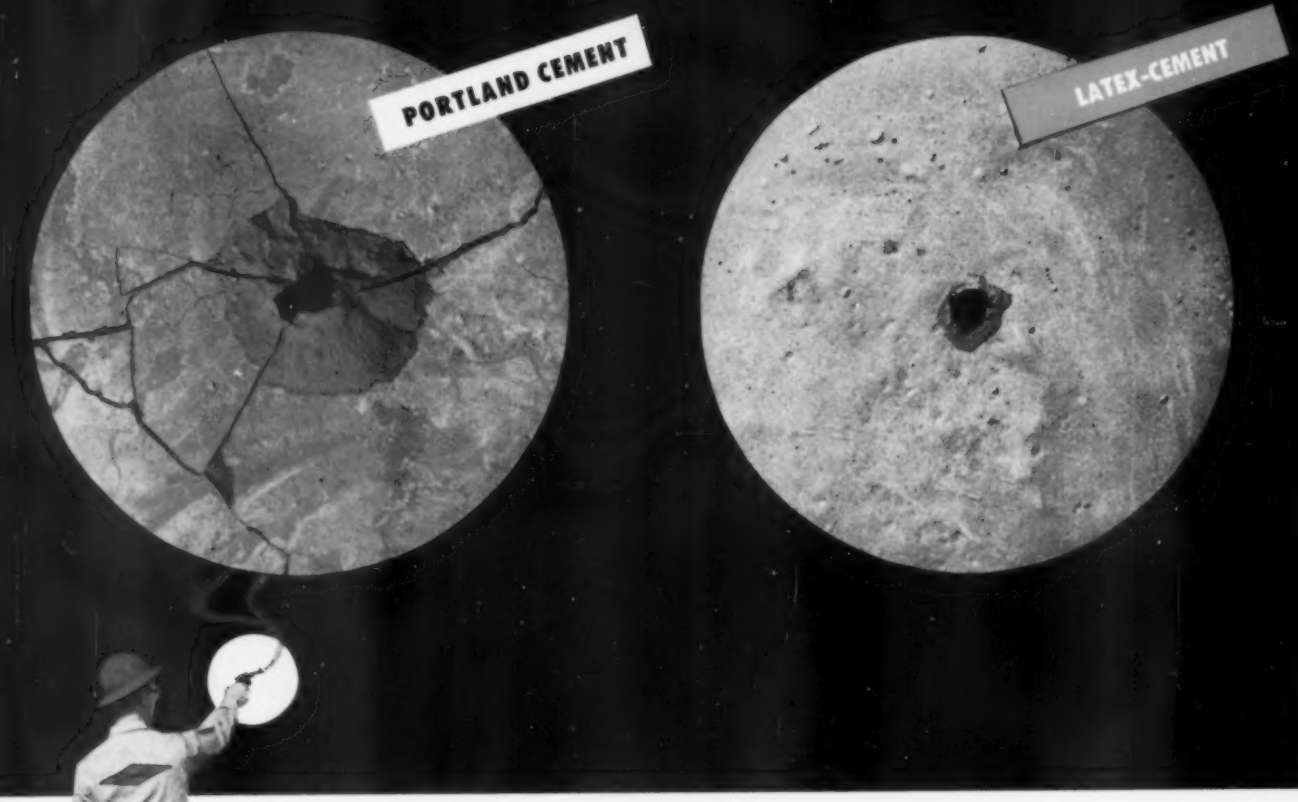

Here's one reason why CEALMENT has given better cement jobs

Most operators have had wells where perforating brought in unwanted gas and water in addition to desired oil production. Cement shattered by perforating shots could have been the cause. Costly squeeze jobs and re-perforating, with attendant rig time, are required to remedy the condition.

Cealment*, an exclusive Dowell service that utilizes latex-cement, helps you avoid many of the causes of faulty cement jobs. Latex-cement is more resilient than common Portland. That's why the man in the photograph could fire a 38-caliber revolver bullet through the latex-cement disk (right) without shattering it. The disk at left is common Portland cement after receiving the same treatment.

Laboratory tests and field experience indicate that the same thing may happen in your well. Cealment is especially useful for cementing a thin oil zone with gas or water nearby.

Resiliency is only one of many advantages of latex-cement. It bonds better, sets more dependably, and has shown excellent resistance to contamination by well fluids. More and more operators are finding that they are money ahead when they use Cealment.

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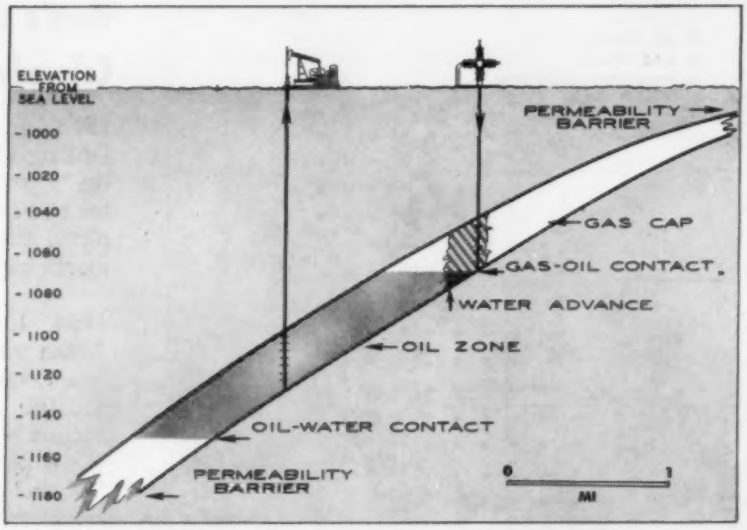
By J. O. Scott

Higher Recovery Promised as . . .

Adena Goes To Updip Water Injection . . . Boost will be from 41 million to 71 million barrels



ADENA FIELD CROSS-SECTION with expanded vertical scale, taken on east-west line. Symbol for injection well represents a line of injection wells which runs on a north-south line. Fig. 1.

ADENA field's new water-flood program is unusual. Water is being injected updip from the oil, above the gas-oil contact. Injection wells are located so that they will sweep all the oil downdip to oil-producing wells.

Adena, Colorado's second largest field and the largest in the Denver-Julesburg basin, is ideally suited for the downdip flooding. Top of the "J" sand, the water-flooded formation, is a gently sloping plane dipping to the west at 47 ft. per mile. Flowing gradient will be much greater than gravity gradient so that water will advance in piston fashion.

. . . The reason for this type of water injection is the gas cap at Adena. The field is a stratigraphic trap defined by permeability pinchouts. Gas overlies oil and oil overlies water. If water were injected into the water zone downdip, some of the oil would be forced up into the gas cap and most of this oil would be lost.

Although oil will be forced down toward the water contact, it will not push into the water zone. Water level has been static during the initial production of the field, indicating a permeability barrier downdip of the oil-water contact.

. . . Origin of the plan was a recommendation by Core Laboratories, Inc., to the Adena field operators back in October 1954. Core Lab's report was released to the Colorado Conservation Commission by the operators. It showed that there was practically no natural water drive in the field and that production drive was due to gas-cap and solution-gas expansion.

Core Lab estimated oil recovery by competitive primary production would have been 40,365,000 bbl., about 30 per cent of the original oil in place. With unitization and water injection at the gas-oil boundary, the recovery was then expected to be upped to 67,519,000 bbl., 50 per cent of the original oil in place.

Not until February of this year was the stage laid for beginning the water-injection program. At that time, the Colorado Oil and Gas Conservation Commission approved Pure Oil Co.'s request for water injection. Pure is operator for the Adena unit. Pure's more recent estimate of ultimate recovery by water injection is 71,000,000 bbl. of oil, an increase of 30 million barrels over that obtainable by primary recovery.

Pure began to inject water early in July. Five producing wells along the gas-oil contact were used as injection wells and 22 others have been drilled.

Fig. 1 shows a generalized east-west cross-section of Adena field with an expanded vertical scale. The point of water injection represents a line of injection wells which runs roughly north and south. Fig. 2 is an areal map of the field showing the unitized area, proposed injection wells, and limits of the oil and gas zones.

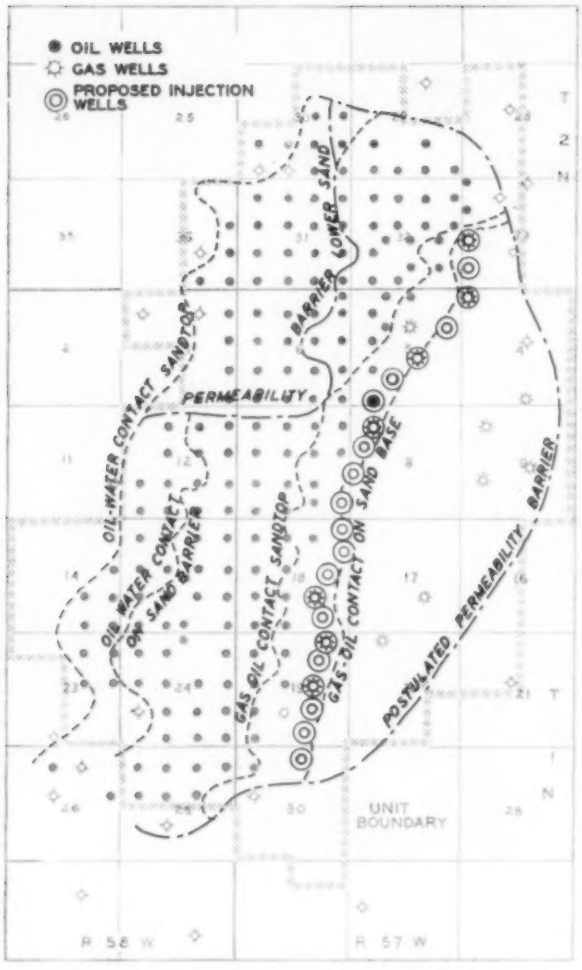
Production from the "J" sand is obtained at an average depth of 5,650 ft., about 1,100 ft. subsea. First wells completed produced from 34 to 1,200 bbl. per day.

The "J" sand reservoir is almost entirely defined by dry holes and has an area of slightly less than 14,000 acres. Initially, the area underlain by oil was about 8,300 acres and that underlain by gas was about 5,000 acres.

Properties . . . Gross "J" sand thickness is about 27 ft. in the oil zone and 18 ft. in the gas zone. Net pay thickness (above 2.5 md.) is 12.3 ft. in the gas zone and 20.2 ft. in the oil zone. Permeabilities range from 0 to 5,120 md. but arithmetic average is 356 md., geometric mean is 138 md.

Nearly 90 per cent of the oil and gas intervals has permeability in ex-

Author was formerly district editor, The Oil and Gas Journal. He is now research engineer, Cities Service Research & Development Co., Tulsa.



AEREAL MAP OF ADENA FIELD shows unitized area, proposed injection wells, and limits of the oil and gas zones. Fig. 2.

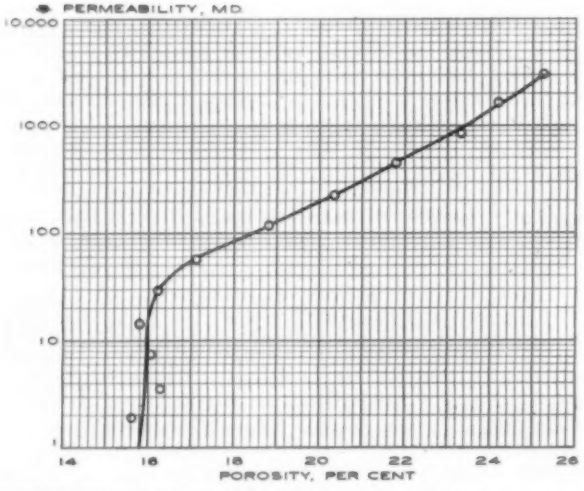
Here's the history of Adena, Colorado's second-largest field

1953 In May 1953, Falcon Seaboard Drilling Co. discovered gas production in the "J" sand. Oil was discovered in November by Petroleum, Inc. Bill Tomberlin completed the first oil well in the sand that month for 900 bbl. per day.

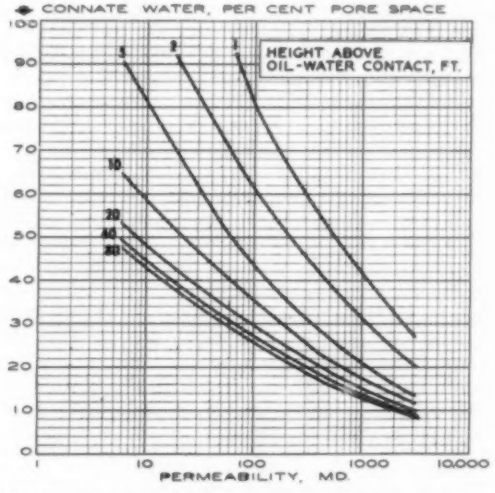
1954 In January 1954, well spacing in Adena was set by the Colorado Conservation Commission at 40 acres for oil wells and 160 acres for gas wells. In June, production was restricted to 125 bbl. or 150 M.c.f. per day per well. By August, 148 "J" sand oil wells and 10 gas wells were completed.

1955 Development became practically complete with 179 oil and gas wells on 11,175 acres. Daily oil production reached about 16,000 bbl. The Adena unit was formed and approved by the Conservation Commission late in the year.

1956 Unitization became effective January 1, 1956, with Pure Oil Co. as operator. Unit was first one for Colorado approved by the Colorado Commission. In July, production from the "J" sand was restricted to 14,000 bbl. of oil with a field-wide gas-oil ratio of 1200. By the end of the year, 65 wells were shut in because of high gas production.



PERMEABILITY INCREASES with porosity, above 16 per cent porosity. Fig. 3.



VARIATION IN CONNATE WATER with change in permeability. Fig. 4.

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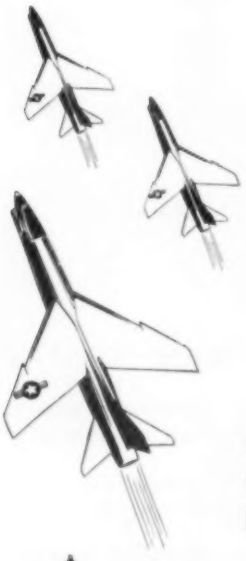
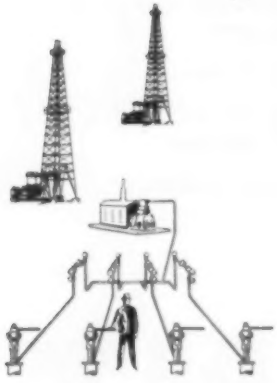


OIL WELL CONVENTIONAL AND HYDRAULIC PUMPING SYSTEMS



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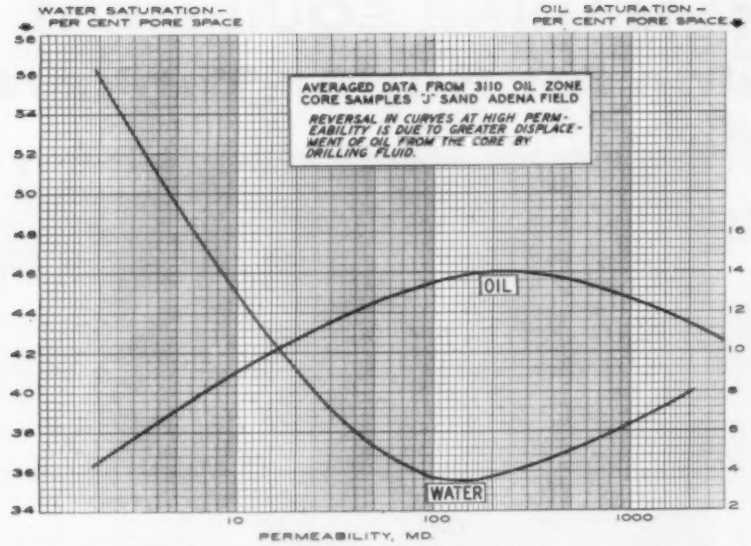
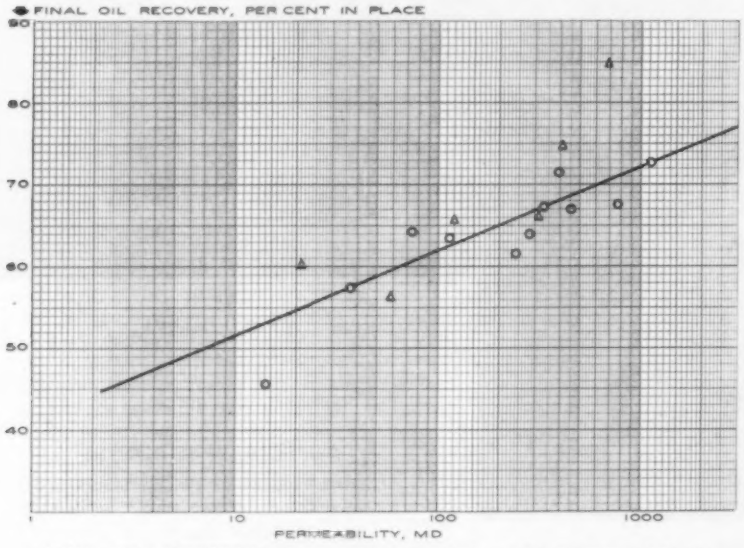

WATER SATURATION – PER CENT PORE SPACE
OIL SATURATION – PER CENT PORE SPACE
AVERAGED DATA FROM 3110 OIL ZONE CORE SAMPLES "J" SAND ADENA FIELD
REVERSAL IN CURVES AT HIGH PERMEABILITY IS DUE TO GREATER DISPLACEMENT OF OIL FROM THE CORE BY DRILLING FLUID.
OIL
WATER
PERMEABILITY, MD.

FLUID CONTENT OF CORES of the oil zone is a function of permeability. Fig. 5.



FINAL OIL RECOVERY increases with permeability of the formation. Fig. 6.

cess of 10 md. Average porosity is 19.7 per cent. Connate-water saturation is 28.5 per cent in the oil zone and 24 per cent in the gas zone.

Above 16 per cent porosity, permeability increases with porosity as shown in Fig. 3. Fig. 4 shows the variation in connate water with change in permeability at different heights above the oil-water contact.

Fluid content of cores of the oil zone is shown in Fig. 5 as a function of permeability. Curves are averaged for 3,110 samples. Reversal of the curves at high permeabilities is due to a greater displacement of oil from the cores by drilling fluid.

Average stock-tank-oil gravity is 43.4° A.P.I. Specific gravity of the gas is 0.735. Solution gas-oil ratio is 526 cu. ft. per barrel at 10 psig. and the original formation-volume factor was 1.36. Stock-tank oil in place originally was 804 bbl. per acre-foot. Reservoir oil viscosity was p. 359 cp.

Reservoir pressure was initially 1,541 psig. and has declined to about 1,200 psi. at the present time. Formation temperature is 178° F.

One sand body . . . Practically all of the oil saturation in the pool is in a massive sand body. Although local shale streaks are present, there is no consistent shale layer in the oil-productive section. The reservoir is bounded by a low-permeability shale-out and thickness decreases toward the edges in all directions except to the northwest.

On the northwest side of the field, additional permeable sand exists below the normal bottom of the "J" sand. In this sand, oil is obtained at depths below those normally water productive or barren in nearby wells, an indication of a barrier between this part and the rest of the field.

Floodability

Displacement efficiency of the "J" sand water flood should be about 65 per cent. This does not include sweep efficiency.

Core-test averages for oil recovery showed recovery at breakthrough of water to be 57.34 per cent and final recovery to be 65.63 per cent. Fig. 6 shows final recovery as a function of permeability. This indicates higher recovery with increasing permeability.

Water-flooding tests were made using oil which was a mixture of 95 per cent refined oil and 5 per cent Adena crude. Water used was a mixture of 86 per cent brine and 14 per cent glycerin. The viscosity of the oil and water were about the same, 1.33 cp. At 76° F. density of water was 1.04 g. per cc. and the oil density was 0.75 g. per cc.

High recoveries at breakthrough were shown by all cores. After water breakthrough, there was a rapid rise in water-oil ratio. Core Lab's tests showed water cut at time of final recovery varied from 99.6 to 100 per cent. Pore volumes required to final recovery varied from 1.95 to 3.81 and averaged 2.6. Tests by another laboratory showed final recovery at an average of 5.7 pore volumes of water.

Injection Program

As shown by Fig. 2, water injection at Adena is along a line near the gas-oil contact on the base of the "J" sand. This will be a line flood and injection wells are planned to keep water advance uniform. This means a higher density of injection wells near the outer edges of the field where the permeability is lower than in the center portion.

Original plans were to use 8 of the existing wells for injection and to drill 15 additional wells. Since Fig. 2 was prepared, the program was changed to use 5 of the existing wells and to drill 22 or 23 wells. Most of these additional wells have been drilled near the ends of the injection line to compensate for the expected lower injectivity there.

Performance . . . Initial water injection rates are expected to reach 50,000 bbl. per day while average daily water injection over the life of the flood may average about 35,000 bbl. Under these conditions, about 2 years

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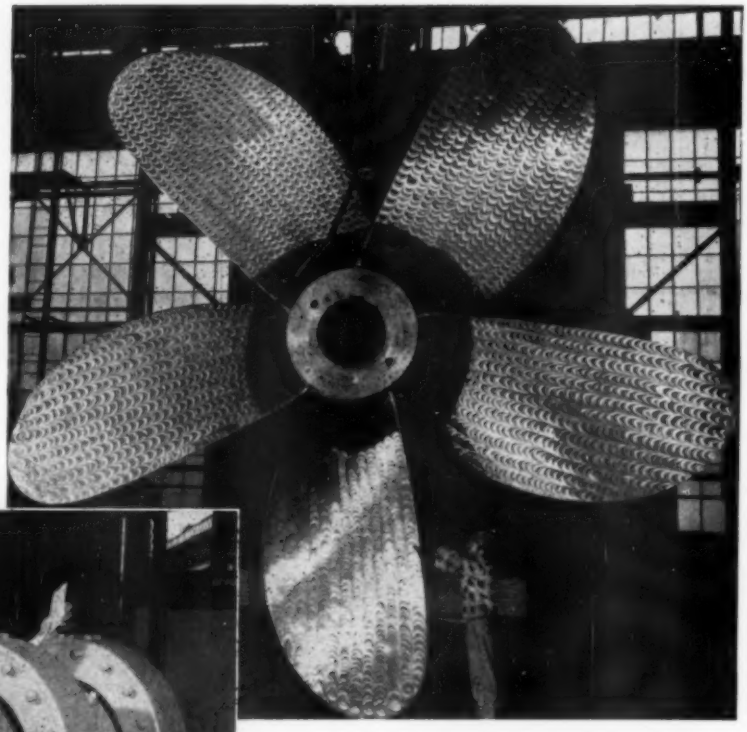
The Nickel-Aluminum Bronze Propeller shown here was designed, cast and finished-machined by Bethlehem for a 46,000-dwt tanker. It has a diameter of 22 1/2 ft and finished weight of 67,200 lb.



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will be required for the water front to coalesce. The complete flood will require about 10 years.

Mobility ratio is expected to be quite favorable for an efficient sweep pattern. With only oil flowing ahead of the flood front and only water behind it, an average mobility ratio (oil over water) was determined to be about 3.3.

The 71,000,000 bbl. of oil that will be recovered with water flooding is about 52.5 per cent of the estimated original oil in place. If water-displacement efficiency averages 65 per cent, the combination of conformance factor and sweep efficiency of the flood would be about 80 per cent. Conformance factor will be high because practically all the oil is in a massive sand body with no consistent shale layers.

Benefit of gas . . . Expansion of gas-cap gas into the oil zone has caused shut-in of many wells during recent primary production. Of 177 field wells, 90 were shut in because of high gas-oil ratio. However, this gas-cap gas should help the flood after a water front is established.

The advancing water flood front will drive the gas ahead of it. This will form a gas saturation in the oil sands without lowering the pressure to cause more gas to come out of solution. The result of the gas saturation is likely to be better oil displacement.

Another benefit of the gas-cap gas should be to reduce the work of lifting the produced water-flood oil. The excess gas will lighten the oil column.

Gas production from gas-cap wells can be allowed after the water front is established and water injection is sufficient to maintain reservoir pressure. So far there has been no production from gas-cap wells, a measure taken to maintain reservoir pressure. Compression of the remaining gas and later flooding by water will help deliverability of the remaining gas when depletion is desired.

Water source . . . Water for the flood is from shallow gravel beds. The water is fresh and is produced by wells similar to those providing irrigation water in the area. Depth of the water wells is about 90 ft., and they have capacities of over 30,000 bbl. per day.

Treatment planned for the water consists of filtering and addition of bactericide and sequestering agent.

Both producing and injection wells at Adena are relatively inexpensive. Wells can be drilled and completed in about a week. Typical completed wells have 8⅝-in. surface casing set at about 120 ft. and 5½-in. casing set through the "J" sand. Casing is perforated opposite the sand for both production and injection.

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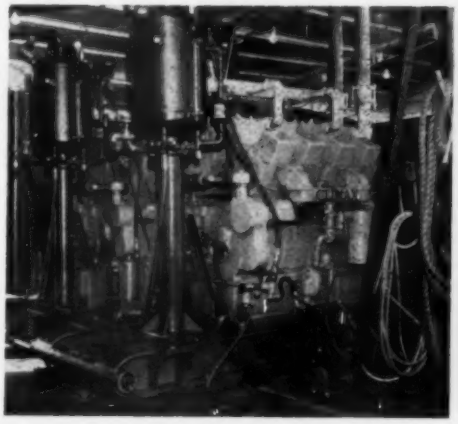
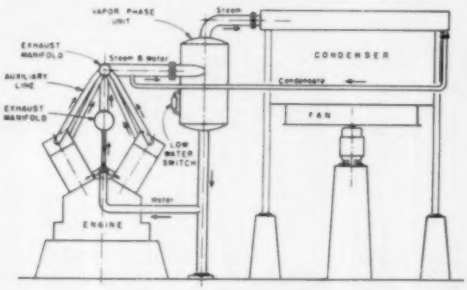


High Temperature Cooling Increases Horsepower; Reduces Fuel, Lube, & Maintenance Costs

Rig No. 1 of Choya Drilling Co., Inc. has increased engine horsepower by nearly 20% at an approximate cost of $6 per bhp., by installing a Vapor Phase cooling system.

WEST Texas' first Vapor Phase cooled rotary rig is in operation at Midland, Texas, headquarters for the Choya Drilling Co., Inc.

In addition to doing away with many of the items essential to conventional drilling engine cooling systems, the Company has increased the power of the rig's two main engines from 265 to 325 hp., while still operating at the same manifold pressures. It is no longer necessary to change radiator cores frequently, or de-scale engine jackets, since the Vapor Phase system is a **closed** system, requiring no make-up water.



Engine jackets are flooded with water at boiling temperature: steam and water go to separator; steam to *portable* condenser (skids not shown). Condensate is drained to hot well, and returned to Vapor Phase system by a pump to maintain proper liquid level.

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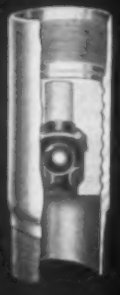
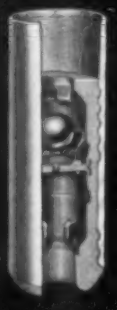


This is the time-tested Baker Cement Float Collar (Product No. 101 M&F) usually positioned just above the shoe joint to provide a "stop" for the cementing plug. Used in combination with any type of Baker Cement Float Shoe, Guide Shoe, or the "Whirler" Shoe, to meet the customer's need.

This is the Baker DIFFERENTIAL Fill-Up Shoe (Product No. 1081) which permits the casing to fill automatically from the bottom while it is being run. A variable valve opens to relieve destructive high pressure surges, and closes to regulate casing fill. Ask for Catalog Supplement No. 301, describing DIFFERENTIAL Fill-Up Equipment.



This is the new Baker FLEXIFLOW Fill-Up Shoe (Product No. 160). Permits casing to fill from the bottom through a hole in a flexible diaphragm that opens up to relieve dangerous high pressure surges, and closes down to control casing fill. Cuts casing running time by as much as one-third. Ask for Catalog Supplement No. 325.

This is the Baker Cement GUIDE Shoe usually run in combination with Baker FILL-UP Collars, or Float Collars when one back pressure valve is considered sufficient. Safely guides casing to bottom. Specify Product No. 102.

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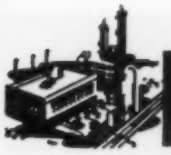

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Making Standard Laboratory Tests

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The test methods used by the laboratory are standard procedures as defined by the A.S.T.M. and are used industrywide. Only the more common tests will be covered in this series. Other tests less frequently used will be discussed separately.

A.P.I. gravity . . . This is the weight per unit volume of 60° F. oil as measured by an instrument described here and called a hydrometer. Specific gravity which is the weight of 60° F. oil divided by the weight of an equal volume of 60° F. water has the following relation to A.P.I. gravity of the same oil at 60° F.:

$$\text{A.P.I. gravity at } 60^\circ \text{ F.} = \frac{141.5}{\text{sp. gr. } 60^\circ \text{ F./}60^\circ \text{ F.}} - 131.5$$

This material taken from process-training-program manual, Baton Rouge, La., refinery of Esso-Standard Oil Co.

Tables are available from which corresponding values of gravities and weights may be read. A 42° A.P.I. gravity oil at 60° F., for example, has a specific gravity of 0.8155 and weighs 6.790 lb. per gal.

The gravity test is run on all petroleum liquids. This test consists of reading a hydrometer and correcting to 60° F. A hydrometer is a sealed tube weighted on one end so that it will float vertically in the oil to be tested. A scale on the hydrometer is then read at the point it crosses the surface of the oil. The temperature must be taken at the same time the gravity is read. For convenience the so-called combined form of hydrometer has a thermometer inside.

Hydrometers for oil read correctly at one standard temperature, namely 60° F. If the oil is hotter or colder than 60° F. a correction must be applied to the reading to reduce it to the standard temperature. To make this correction, the temperature and gravity readings are referred to a correction table where the A.P.I. gravity at 60° F. is found.

A.S.T.M. distillation . . . This test specifies the equipment dimensions and the rate at which heat is applied. In distribution the oil vapors are removed, condensed, and measured. The temperature rises as the lighter fractions are boiled off. This type of separation is useful to determine:

1. At what temperature the first condensable vapor is removed (initial boiling point).
2. What percentage of the total volume is not condensable.
3. How the lighter and heavier fractions are distributed through the oil.
4. Approximately how much of the sample will vaporize below a given temperature. Or the opposite to this, how much of the oil will remain a liquid at a given temperature.
5. What temperature is required to vaporize all of the material, (final boiling point).
6. How efficient the separation is between two side streams from the same tower by comparing the distillations of the two streams.

This test is used on all light oils and distillates.

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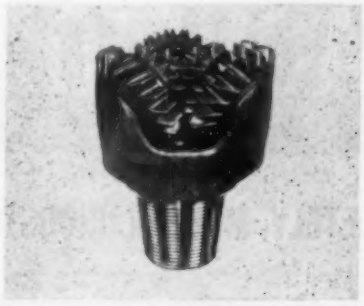

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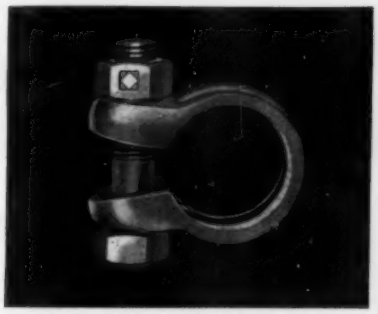

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By W. L. Nelson
Technical Editor

Cost of Ethylene Plants

Can you please furnish additional information regarding the cost of ethylene plants reported in your COST-imating No. 29 Over-all Plant Costs, May 6, 1957? Especially we are keen to know: (a) Types of charge stock; (b) battery limits of the plants and (c) dates of the 10 references.—P.C.

The plant costs of COST-imating Numbers 26-30 of the COST-imating Series consist almost totally of costs reported in the news literature, and it is therefore impossible to be specific regarding the details of their processing, design, or completeness. They are admittedly most approximate (see Fig. 1) and yet they have the advantage of being, in most instances, actual costs rather than estimates. It has frequently been noted that plant costs prepared by computations usually fail to be representative of the actual costs of installed plants, being very high or very low, and they probably reflect varying degrees of optimism or conservatism as well as legitimate differences in cost.

In the case of the ethylene plant costs shown in Fig. 1, all plants except the two highest triangle points are thought to employ light-hydrocarbon feed stocks. The plants represent constructions since 1938 (the first major plant). The solid points bear dates of 1938 and 1946-1948 whereas others are dated 1952-1957. The one very low point is probably due to the fact that this plant is associated with several other large chemical plants which share some of the costs, and the high square point is an estimate obtained by subtracting the cost of another installation from a total cost. The triangle points are low computed ones which represent only the process part of the installation.

Changes in processing methods during the years seem to have resulted in higher plant costs rather than lower ones. The validity of the cost index used (in this case the Nelson Index) does not enter into the situation because the same index was used for both converting original costs to 1946 and in converting 1946 costs to current dates. However, the cost of recently constructed plants may have an effect by causing the 1946 cost line to be raised or lowered.

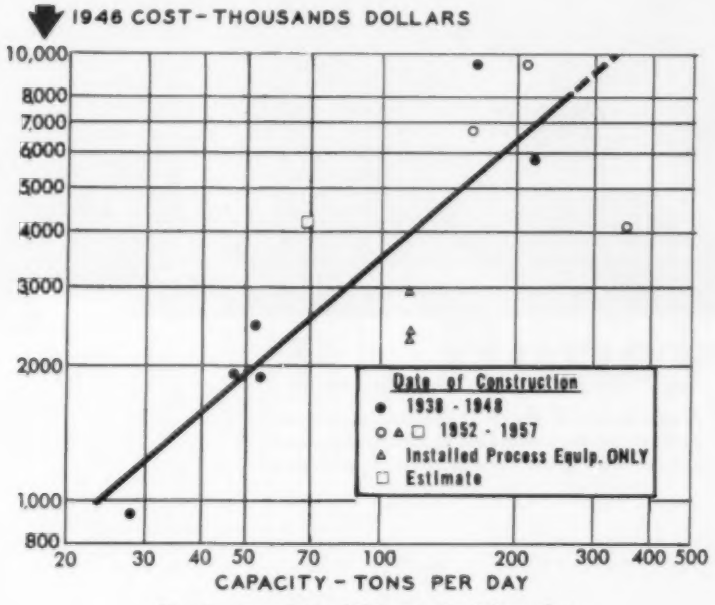


Fig. 1—Approximate 1946 cost of ethylene plant.

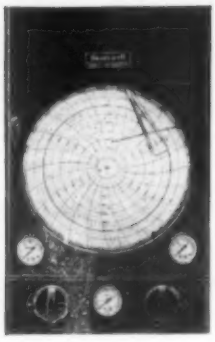
Recent Cost Data

Your COST-imating booklet of 1950 is quite useful but the effect of inflation during these 6 years must have been 30-35 per cent. How can we get recent information such as your COST-imating?—J.F.McG.

A revised and more recent COST-imating series is being published but it states 1946 costs just as all costs in the various cost publications in The Oil and Gas Journal under the heading COST-imating. Inflation is not 30-35 per cent but averages 96 per cent since 1946 (see Nelson Refinery Construction Cost Index).

The question of inflation has been raised repeatedly. Somehow our readers do not seem to understand that The Oil and Gas Journal is attempting to keep all cost information up-to-date by means of Cost Indexes. These indexes are not to be considered as generalities about inflation, they are multipliers that can be used to convert 1946 costs (or costs at other years) to the most recent dates. Obviously, the proper indexes must be selected, i.e., index for steel plate when dealing with tanks or vessels; lumber indexes for lumber, etc. Over 46 selected indexes are published each quarter on the Itemized Indexes page of The Oil and Gas Journal (also labeled COST-imating). In addition, the first issue each month contains the Nelson Refinery Construction Cost Index (an average of refinery construction) as well as indexes for (1) pumps, compressors, etc., (2) electrical machinery, (3) internal-combustion engines, (4) instruments, (5) heat exchangers, (6) average material, and (7) construction labor.

The Journal is pleased at the enthusiasm expressed regarding the COST-imating series, but the even greater usefulness of Cost Indexes should not be overlooked. With cost indexes we are able to marshall literally thousands of costs or prices which have been stated in the past; without cost indexes every cost experience of the past loses most of its usefulness and, in fact, may be misleading. No other agency than the Journal (resting heavily, of course, upon costs or indexes issued by U. S. Government agencies) is attempting to provide means of keeping cost information up-to-date.



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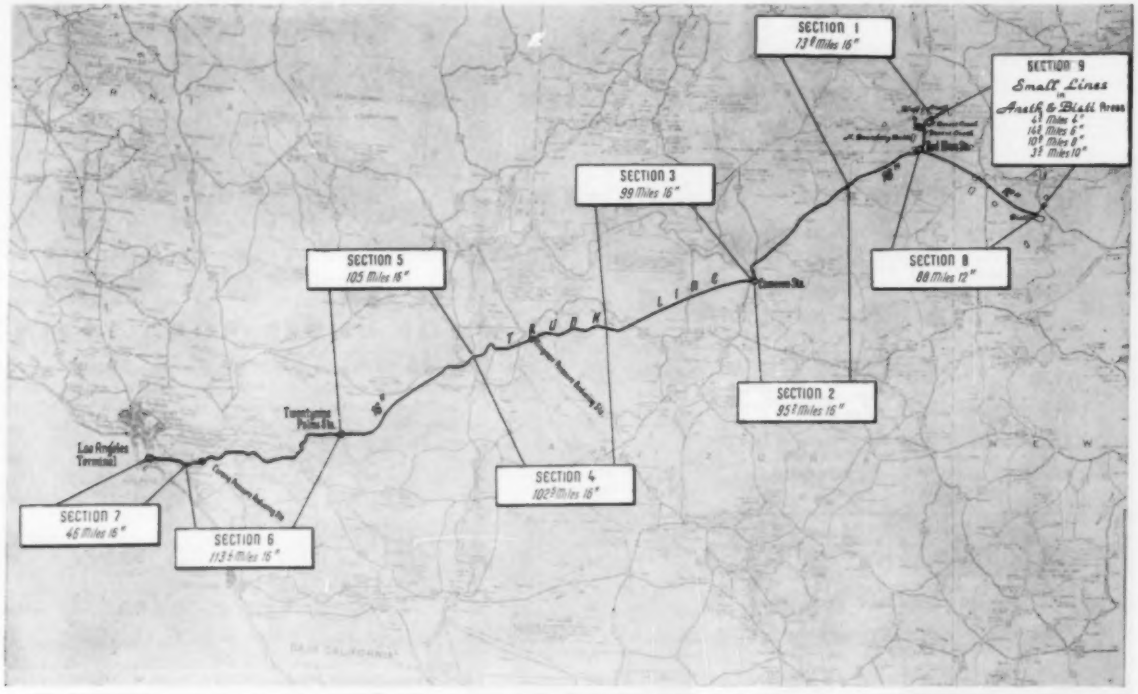


FOUR CORNERS crude line is being built in nine sections from Aneth and Bisti producing areas of Utah and New Mexico to Los Angeles refineries.

Spreads clip off 2 miles per day as . . .

Four Corners line moves ahead rapidly

Pipeliners work through loose sand and solid rock of remote desert country. Two pressure-reducing stations will be built to offset effect of elevation drop.

By Ed McGhee
District Editor

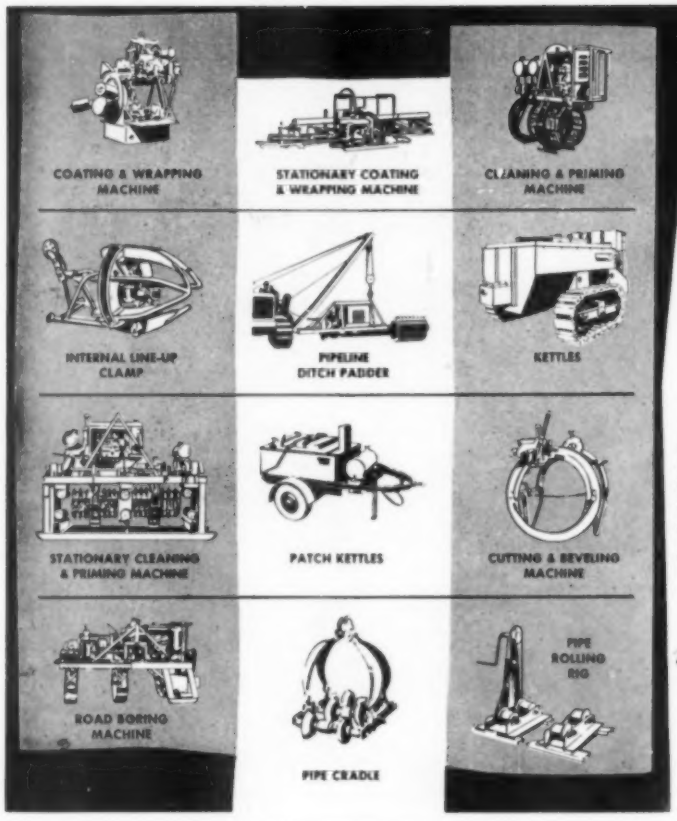
CONSTRUCTION on Four Corners Pipeline is rolling along at a fast clip. Each of the first three spreads at work made about 2 miles per day. Some days, one spread put as much as 15,000 ft. of pipe into the ground.

Work started on the 750-mile line in July. Shell Pipe Line Corp., which will operate the line, expects it to be completed in January. Sections will start filling with oil in October. When complete, the line will hold 750,000 bbl. of oil. It will move crude from the Aneth and Bisti areas (see map) to Los Angeles refineries.

Contractors . . . There are seven sections of the main 16-in. line totaling 635 miles. In addition there is an 88-mile section of 12-in. main line. The ninth section is made up of 32½ miles of gathering lines in Bisti and Aneth fields.

A.P.V. Co., Inc., Fort Worth, Potashnick Construction Co., Cape Girardeau, Mo., and R. H. Fulton & Co., of Lubbock, are working on Sections 1, 2, 3, and 8. Fulton has the contract for Sections 5 and 6 which will be started when fall brings cooler temperatures to the desert.

REMOTE CAMP for A.P.V. spread is set up 50 miles from paved road.



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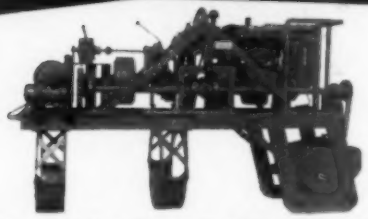

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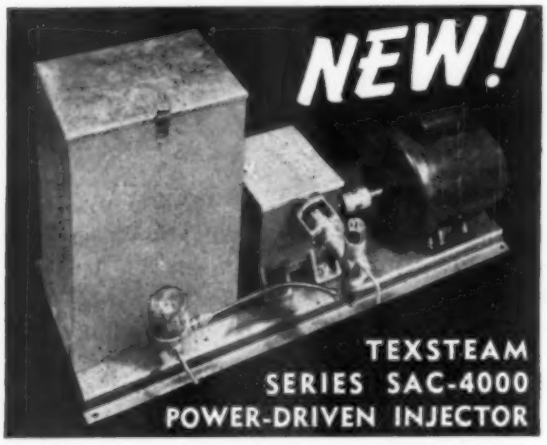

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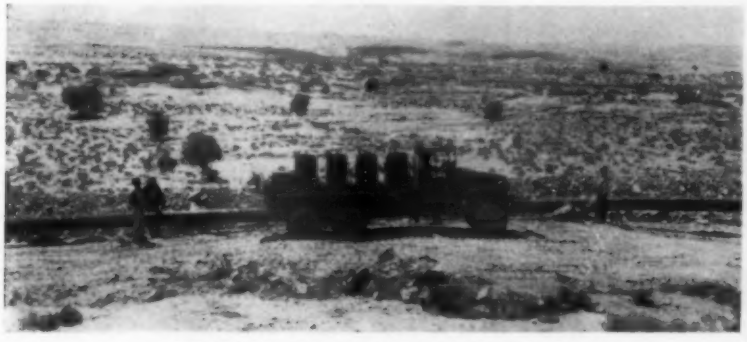
PIPELINE PATROL

WAGON DRILL punches hole to blast ditch through rock.

PIPE GANG joins 40-ft. joints of 16-in. pipe.

STRINGER BEAD is applied by two welders.



HOT PASS weld comes after the stringer bead.

Right-of-way is complete except for tracts on the Los Angels end.

Contract was let on August 9, to Potashnick and A.P.V. Co. for section 4. Contracts were let to Pacific Pipeline Construction Co., of Montebello, Calif., and Standard Pipe Line Construction Co., of Farmington, N. M., for Sections 7 and 9, respectively. Work is under way.

Rocky and remote . . . Four Corners Pipeline runs through hot and lonely country. Roads are few and towns are far apart along most of the line. Since there was no place for personnel to live nearby, A.P.V. was forced to set a camp for its crews working on Section 1. This camp is about 50 miles from the nearest paved road and more than 2 hours from the nearest town.

On the right-of-way, daytime temperatures of 120° F. are not uncommon. Moreover, rattlesnakes, gila monsters, and scorpions like to lie in the shade of the pipe. When the pipe is moved, these creatures are likely to bite at anything or anyone nearby.

The terrain alternates between deep, loose sand and solid rock. The sand is as much trouble as the rock and makes it impossible for an ordinary car to travel the right-of-way.

Construction . . . There's enough solid rock that wagon drills and dynamite have to be used frequently. But the ditcher can generally cut the first foot or two of ditch. In the

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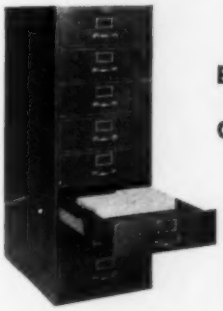

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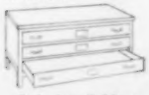

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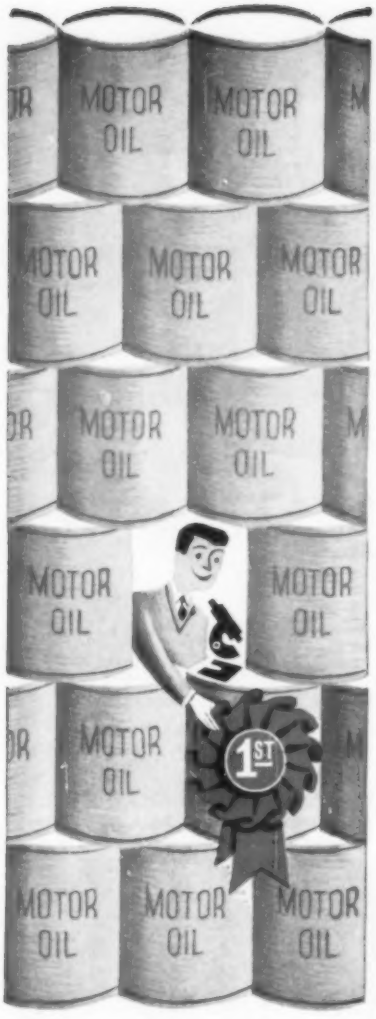

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. . . AND CRADLED into the ditch.

BACKFILLER follows close behind coating and wrapping.

WATER WELL is drilled at pump station site.

sandy areas, ditching proceeds about as fast as a man can walk, and so this phase of construction is not unusually expensive.

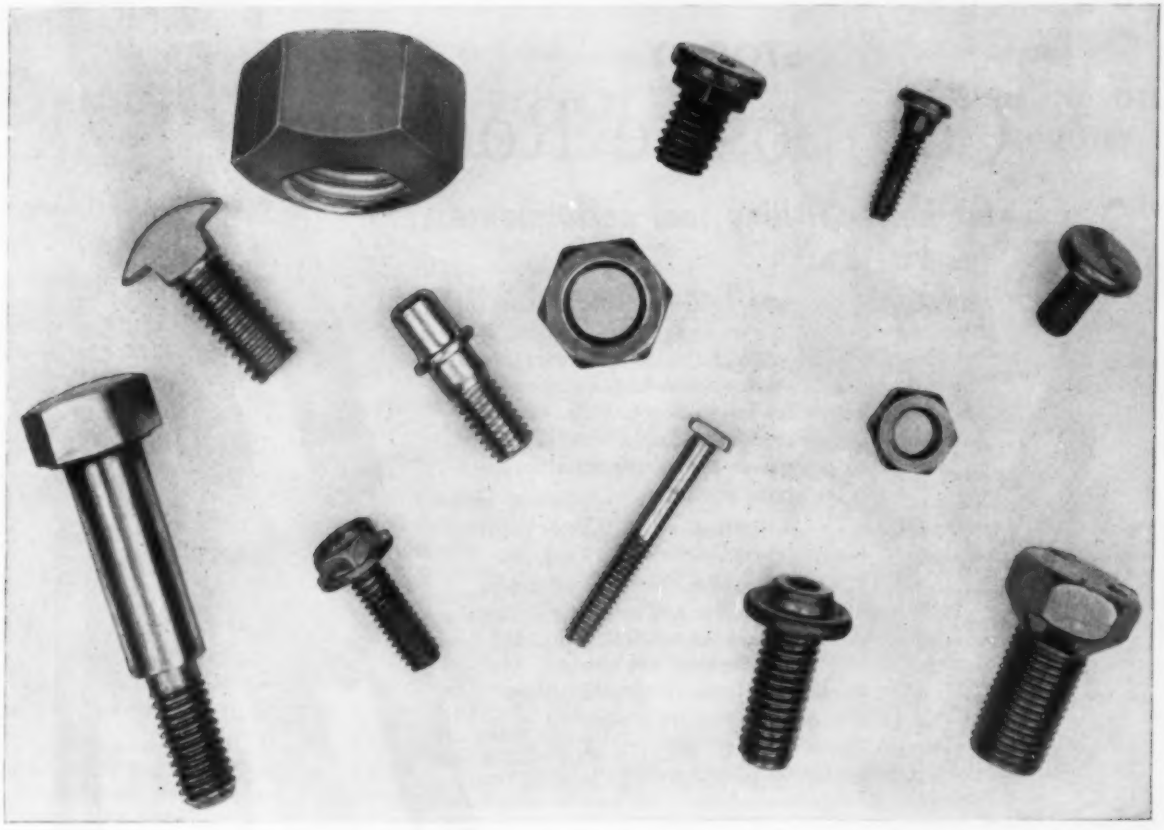
Time is saved by cradling into the ditch behind the coating-and-wrapping machine. Through rock sections, the bottom of the ditch is padded with sand and loose soil. Backfilling follows coating and wrapping closely.

Pump stations . . . There will be three pump stations on the Four Corners line: one at Red Mesa in southeastern Utah where the lines from Bisti and Aneth join; one at Cameron 150 miles down the line from Red Mesa; and the third at Twentynine Palms, 150 miles from the western terminal at Los Angeles.

The line pressure will get a big boost from the drops in elevation along the line. The drop is enough that two pressure-reducing stations will be needed. One will be in Kingman, Ariz., and the other at Corona, some 40 miles east of Los Angeles.

Plans call for automatic equipment at each of the pump stations and pressure-reducing stations. In fact, some may operate unattended, under control from the Los Angeles end of the line. Since oil will come into Red Mesa station from two directions, it will likely be attended at all times.

The Four Corners line is owned by Standard Oil Co. of California and Shell Oil Co., each with 25 per cent; Gulf Oil Corp., 20 jer cent; and Superior Oil Co., Richfield Oil Co., and Continental Pipe Line Co., 10 per cent each. **End.**



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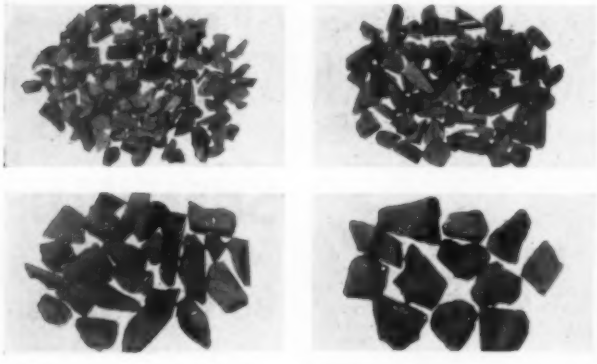

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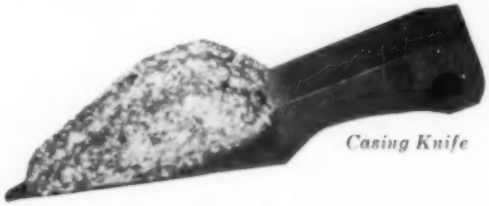

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G. E. STEVENS

L. A. COOK

He comes to the Signal organization to supervise its rig operations in the Rocky Mountain area. Stevens is married and lives with his wife, Helen, son, and daughter at 2230 Crescent Avenue in Casper. He is a member of his local A.A.O.D.C. chapter, the Petroleum Club and Elks Lodge.

Allen Cook joins the company as exploration manager with headquarters at 415 Petroleum Club Building, Denver, and will be in charge of its efforts on farmouts and interest deals. He was recently released from active duty in the U. S. Air Force at Wichita Falls, Tex. Prior to entering the service he was associated with C-G Drilling Co., Wichita, Kans. Allen was graduated from the University of Tulsa with an Arts and Science degree in 1954. He is married and resides at 3323 Kearney, Denver, with his wife, Sally, and two young daughters.

The home office of the company is in Tulsa, Okla., with division offices located in Denver and Casper.

Vasser & Brown, Inc., Natchez, Miss., is contractor on a Wilcox wildcat test R. H. Alagood and Kinsey & Kinsey, of Shreveport, are starting at 1-D Wurster-Madison, in 16-6n-8e, 7 miles southwest of Willetts, in Concordia Parish, eastern Louisiana. Permit is for 6,500 ft. The rig was moved from another Wilcox test which the contractor has just completed drilling for Alagood and Norton Oil Corp. at a wildcat location 2½ miles northeast. These tests are southeast of Horseshoe field.

Thrasher Drilling Co., Shreveport, is drilling for Hunt Oil Co., also of Shreveport, at a wildcat location 2 miles south of Catahoula Lake field, in southern LaSalle Parish, Louisiana. It is a 5,500-ft Wilcox test at 131-H Louisiana Delta, in 17-6n-4e. Location also is about 3 miles northwest of West Elm Ridge field.

Sunnyland Contracting Co., Rayne, La., has a new wildcat operation in northeastern Iberville Parish, South Louisiana. It is a 10,500-ft. test for Serio-Punches Oil Co. Location, at 1 Schwing, in 62-7s-9e, is about 2½ miles north of the Rosedale area, and about the same distance south of Maringouin field.

Lee Drilling Co. will handle contract for Joe Bailey 1-A Baschky, C NE SE 3-34n-63w, a Niobrara County, Wyoming, wildcat in the Hat Creek area.

Nye & Snell Drilling Co. will handle contract for a wildcat 1 mile north of North Craig field in western Colorado's Moffat County. The wildcat will be the U. S. Smelting, Refining & Mining Co. 1-29 McWilliams 8-90. It is located in SE SE NE 29-8n-90w. Drilling will go to 3,400 ft. or the Fox Hills.

Milton Crow, Inc., Shreveport, was named contractor for G. B. Christmas' 3,800-ft. wildcat 1⅛ miles east of Genoa field in Miller County, South Arkansas. The 1 Woody Purifoy, C SE SE SW 11-16s-27w, is 2⅝ miles southeast of the town of Genoa, Ark.

Crow-Greyhound Drilling Co. will handle contract for a 3,900-ft. Tuscaloosa west outpost to production in Lucky field, Bienville Parish, northwestern Louisiana. The well is the David Crow, Trustee, 1 H. J. Myrick,

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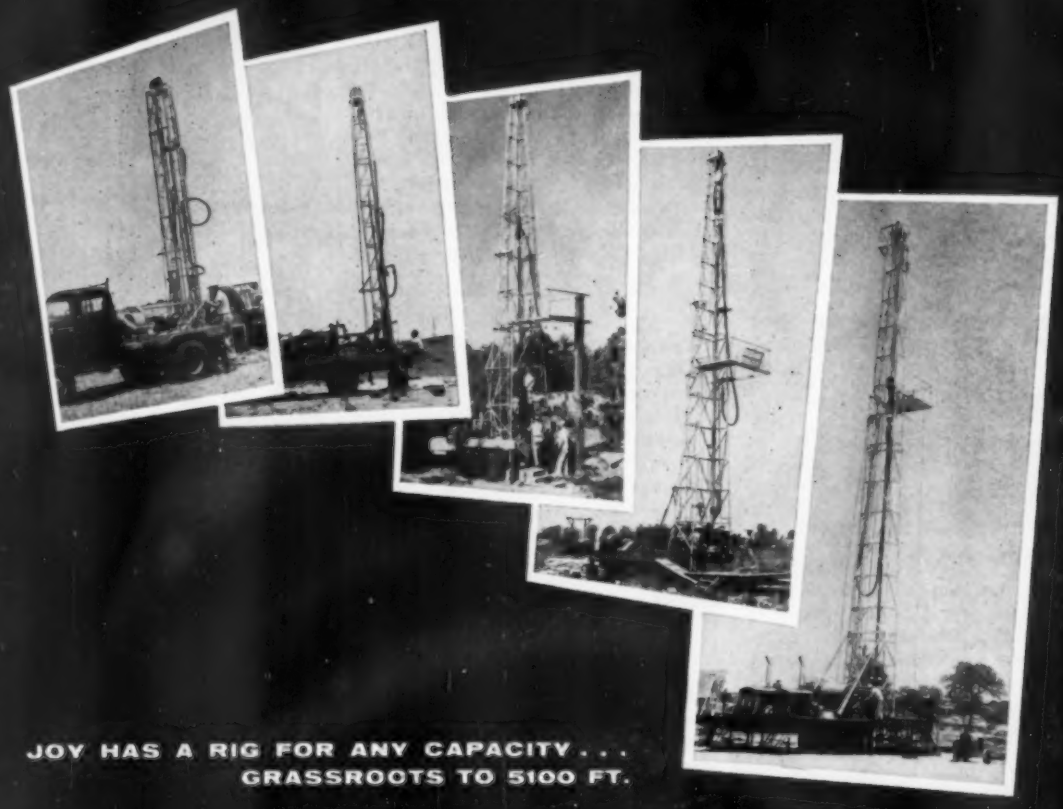
HOW DEEP ARE YOU DRILLING?



JOY HAS A RIG FOR ANY CAPACITY . . .
GRASSROOTS TO 5100 FT.

CAPACITY		FEEDS AVAILABLE
350	35-C	Chain Pulldown
600	35-CE	Heavy Duty—Chain Pulldown
1250	125-C	Chain Pulldown
1250	125	Hydraulic Feed
1500	125-CE	Heavy-duty—Chain Pulldown
1500	125-E	Heavy Duty—Hydraulic Feed
1800	225	Hydraulic Feed
1800	225-W	Wt. of String
2500	250	Hydraulic Feed
2500	275-W	Wt. of String
3400	340	Wt. of String
5100	510	Wt. of String

JOY PRODUCES A TOTAL OF TWELVE DIFFERENT RIGS with capacities ranging from 350 feet for the 35-C shot hole rig to the Joy 510 for deep exploration or slim hole production to 5100 feet. NO OTHER MANUFACTURER can match a rig to your requirements as well as Joy.

With twelve rigs in our line we can make impartial recommendations . . . can specify the *best* rig to suit *any* given set of drilling conditions. Let us quote on a rig for you . . . write to ***Joy Manufacturing Company, Oil Field Drill Division, P.O. Box 35326. Airlawn Station, Dallas 35, Texas.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

WSW O-6726-186

JOY . . . EQUIPMENT FOR THE OIL FIELDS . . . FOR ALL INDUSTRY

Write for FREE Bulletin 186-31

28 SALES & SERVICE LOCATIONS

Joy Manufacturing Company, Duluth, Minn.; El Paso, Texas; Knoxville, Tenn.; New York N. Y.; St. Louis, Mo.; Salt Lake City, Utah; San Francisco, Calif.; Birmingham, Ala.

Baash-Ross Tool Co. Div.—Abilene, Corpus Christi, Houston and Odessa, Texas; Harvey, New Iberia and Shreveport, La.; Ardmore and Oklahoma City, Okla.; Avenal, Bakersfield, Long Beach, Newhall, Taft, and Venture, Calif.; Casper, Wyo.; Hobbs and Farmington, N.M.; Olney, Illinois.

Export Sales—Joy Manufacturing Company, 60 E. 56th St., New York, N.Y.

C NE NW 15-15n-7w. Location is 1¼ miles west of Travis Peak gas production and 1½ miles southwest of Tuscaloosa oil production.

Woolf & Magee, Shreveport, will handle contract for a new wildcat at A. J. Hodges Industries, Inc., and Associates A-2-Louisiana Central in C NE¼ 24-10n-5e. The 8,500-ft. Tuscaloosa wildcat is 2½ miles southeast of Sherwood in Catahoula Parish, East-Central Louisiana.

Crow Drilling & Producing Co. will handle contract for a 5,200-ft. Wilcox test for Durbin Bond Co., Inc., at 1 Tensas Delta Land Co. in Catahoula Parish, Louisiana. The well is 3¾ miles west of Tew Lake field.

Big Chief Drilling Co., Oklahoma City, will handle contract for a 13,500-ft. Sligo deep wildcat inside Holly Ridge field, Tensas Parish, Louisiana. The well is Pan American Petroleum Corp. 1 R. D. Shelly Unit in NE NE 30-11n-10e, 1 mile north - northwest of Holly Ridge town. Location is being cleared.

Bagley Drilling Co., Shreveport, will handle contract for a 3,500-ft. Paluxy wildcat at R. A. Stacy and Associates 1 Boies Estate in NW SE 32-16n-7e, ¾ mile north of Mangham and 1¾ miles southeast of Richland field, Richland Parish, northeastern Louisiana.

Himson & Smith Drilling Co. has contract for a 9,600-ft. wildcat in 112-6s-9e, south-central Pointe Coupee Parish, South Louisiana, for Peter Henderson and H. Curtis Plumly companies. The 1 Holloway Plantation is about 4½ miles southeast of Fordoche field with dry holes on the south, north, and northeast.

Delta Drilling Co. has been let contract for a Lafayette Parish wildcat, South Louisiana. The Monsanto Chemical Co. 1 Girouard will be a west extension attempt to the two-well Broussard field. Location of the well is 14-10s-5e, 4,100 ft. west and a bit north of the 1 Tortue, field discovery well.

Justiss-Mears Drilling Co. has contract for an 8,900-ft. Wilcox wildcat in East Feliciana Parish, South Louisiana, for C. B. Pennington et al. The 1 Joe T. Howell is in 60-2s-1w.

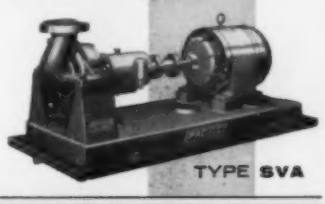
Brewster-Bartle Drilling Co. has been awarded contract for an 11,000-ft. wildcat in Taylor Pass, Plaquemines Parish, South Louisiana. The wildcat will be the Monterey Oil Co. and The California Co. 1 State Lease 1786, east of the Coquille Bay area.

Whatever your Pumping Problems–

PACIFIC®

PROCESS PUMPS

give you the right answers!



TYPE SVA

RATINGS	TYPE SVA	TYPE SVS	TYPE SVC	TYPE RVC
Capacity – in GPM	15 to 1300	15 to 1000	25 to 3200	50 to 600
Pressure – in PSIG	To 600	To 600	To 600	To 600
Head – in feet	To 600	To 600	To 600	To 900
Temperature – °F	To 300	To 300	To 850	To 850
Number of stages	One	One	One	Two

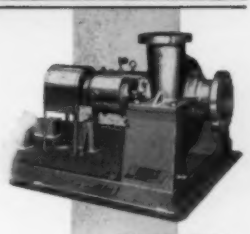
DESIGN
PACIFIC'S skillful mechanical and hydraulic design.

MATERIALS
Top-quality materials of construction for the service conditions involved.

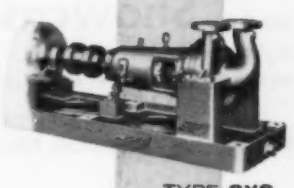
WORKMANSHIP
Precision workmanship by PACIFIC'S skilled craftsmen.

Included in the characteristics of all PACIFIC process pumps are the elements of unequalled quality that have made them preferred in petroleum refineries, natural gasoline plants and petrochemical installations throughout the world. For the pumping requirements of your process plant – The name to remember is PACIFIC.

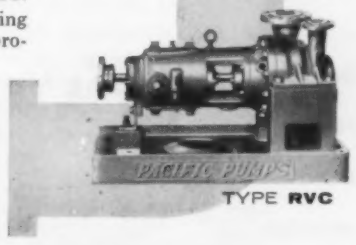
Write for Bulletins, describing and illustrating PACIFIC process pumps.



TYPE SVC



TYPE SVS



TYPE RVC

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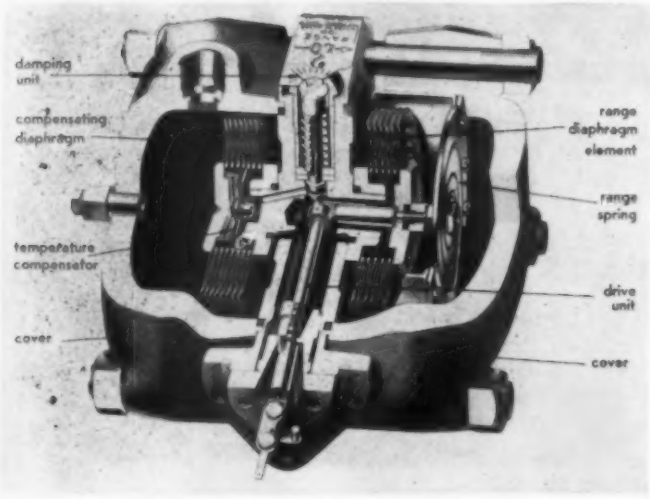
CP15

SHOWCASE...

NEW EQUIPMENT



Diaphragm Meter Gives Positive Protection

Preformed sensitive diaphragms, stacked to nest together, give positive overrange protection to full static pressure in this new Foxboro Type 37 diaphragm meter, according to the maker. Each pair of diaphragms forming the low-pressure (range) and high-pressure (compensating) diaphragm element is welded at the outer circumference and to the opposing faces of the series of spacing rings at the inner circumference.

Overrange pressure on either element forces filling fluid through a connecting passage, around an adjustable damping plug, and into the opposite element. The unit, under pressure, compresses so the spacing rings form a metal-to-metal column. And each pair of diaphragms is nested, preventing overrange damage, the maker reports.

Measurement is unaffected by temperature variation of the liquid in the elements. A bimetallic compensator inside the high-pressure element varies the fluid capacity of the element according to temperature changes.

The low-pressure element works against a thermally stable range spring. It is connected to a bellows-sealed drive arm which operates through an Elgiloy metal flexure to drive the indicating or recording mechanism.

Differential ranges are 0-20, 0-50, 0-100, and 0-200 in. of water. The meter is available in a rectangular or circular case, yoke or flush mounted, for a 2,000-psi. maximum pressure.

The diaphragms are of Type 316 stainless steel. The body is of forged steel, cadmium plated or Type 316 stainless steel. Pressure connections are tapped for ¼ or ½-in. N.P.T., optional by turning the end caps. **Write or call: Foxboro Co., Foxboro, Mass., for details on Type 37 diaphragm meter.**

●

Plastic Mud Funnel Permits Easy Handling

Easy handling of hot muds is offered by this new plastic mud funnel, according to the maker. Developed for use in checking the viscosity of drilling

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

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Described in OIL AND GAS JOURNAL - Issue of September 23, 1957

NAME.....**TITLE**.....

COMPANY.....

ADDRESS.....

CITY.....**STATE**.....

DATE.....

Field-Replaceable Dogs Reduce Overall Costs of

MISSION "ROLLING DOG" TUBING SPIDERS

THE SLIPS USED in Mission Tubing Spiders feature field-replaceable "Rolling Dogs" for positive grip and instant release. Simply by changing dogs, the operator can change slip size or completely renew the gripping surface at a fraction of the cost of new slips.

Mission Tubing Spiders are simple, rugged and easy to handle. They can be operated quickly and easily either at floor level or on the tubing head.

Save time and money. Use Mission "Rolling Dog" Tubing Spiders. They are available through all supply stores.

Nothing but the finest will bear the name of MISSION MANUFACTURING CO

MISSION MANUFACTURING CO. • P. O. Box 4209 • Houston, Texas • Cable Address—"Missco" • Export Office: 30 Rockefeller Plaza, New York
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Looking in on . . .

fast mud mixing

This is what a large number of mud tanks look like on drilling barges all up and down the coast.

The powerful mud flow that's created here comes from the two big turbine impellers on this LIGHTNIN Mixer. It represents your best way to get fast mud mixing.

Change mud in seconds

When you mix with LIGHTNIN Mixers, you can actually increase the weight of every gallon of mud in the tank by the exact amount you want in *a few seconds.*

Just add weight and gel to the mud through a high-speed LIGHTNIN Flash Mixer and you get an immediate rise through the whole system. Within a few minutes, weight and viscosity are completely equalized.

See for yourself

Ask your LIGHTNIN sales engineer or supply company representative to show you a nearby rig where LIGHTNINS are at work. He'll arrange a field trip to a barge or land rig in your area.

You'll find his name listed in the Composite Catalog. Contact him today—or write us direct.

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174-j Mt. Read Blvd., Rochester 11, N.Y.
In Canada: Greey Mixing Equipment, Ltd.
100 Miranda Avenue, Toronto 10, Ont.

Lightnin® Mixers
MIXCO fluid mixing specialists

New Equipment

muds at the rig, it is designed to meet the specifications of the Marsh funnel viscosimeter described in A.P.I. Code RP-29.

The funnel itself is made of a plastic molded material that withstands both high and low extremes of temperature. The screen insert that strains cuttings from the mud is made of stainless steel.

Easy to clean and maintain, the funnel is precision calibrated for accuracy. It is said to be usable at high mud temperatures and is rust and corrosion-proof and resistant to breakage or bending.

Write or call: Equipment Dept., Magnet Cove Barium Corp., P. O. Box 6504, Houston 5, Tex., for details on plastic mud funnel.

•

Digital Computer Controls Process Plant

Fully automatic control for process plants is provided by this new digital-control computer, according to the manufacturer. Known as the RW-300, it is a fully transistorized computer specifically designed to automatically control such processes as oil refining. It also can be used for general-purpose scientific computation or to perform the monitoring function of a data logger, the maker says.

As a central unit of a process-control system, the computer reportedly will: (1) automatically read process instruments, (2) perform the computations necessary to relate these readings to process objectives, (3) determine the control actions that will result in the best plant operation, and (4) activate process mechanisms or adjust set points on supervised control loops.

Weighing about 400 lb., the RW-300 measures 55 in. long by 28 in. wide by 36 in. high. **Write or call: Ramo-Wooldridge Corp., 5730 Arbor Vitae Street, Los Angeles 45, Calif., for details on RW-300 computer.**

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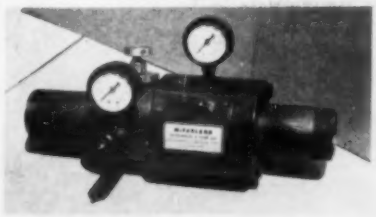


Safety Shutoff Valve Stops Flow

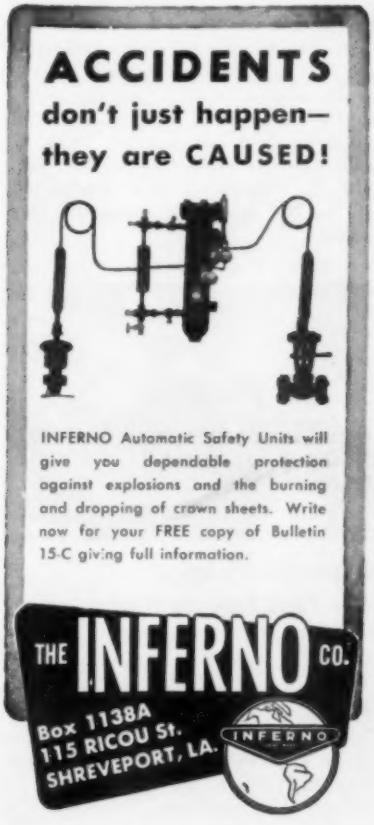
This valve, when installed directly in the flow line, shuts off the flow of liquids or gases automatically should a line or hose break downstream from the valve, the maker reports. Operating from a differential pressure, the valve is equipped with an adjustable orifice to enable the operator to set the valve to any degree of sensitivity desired.

The valve does not close with a snap action. Instead, it is so arranged that the closing action is done slowly to prevent sudden jarring action. The valve, once closed, is opened manually by using a high-pressure grease gun.

The valve is suited as a safety device on flowing wells, automatic custody transfer units, and loading racks for butane, propane, and gasoline, according to the maker.

When installed in a reverse position, the valve can be used to control excessive pressure buildup downstream from the valve, a desirable feature for pipelines in mountainous areas where excessive pressures are apt to occur due to the terrain. When used for this purpose, the valve opens and shuts automatically as pressure varies.

The valve is available in pressure range to 10,000 psi. and sizes of 1 through 24 in. **Write or call: McFarland Engineering & Pump Co., 1206 Nance Street, Houston, Tex., for details on automatic safety shutoff valve.**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don't just happen—
they are CAUSED!
INFERNO Automatic Safety Units will give you dependable protection against explosions and the burning and dropping of crown sheets. Write now for your FREE copy of Bulletin 15-C giving full information.
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SHOWCASE . . .

New Equipment

Spray Lubricator Offers Many Uses

In this pneumatic spray lubricating system, oil is atomized in the nozzle of a spray valve by compressed air. The spray system may be gravity, syphon, air, or pump operated.

The pneumatic spray valves are of the external-mixing type. This feature is said to reduce objectionable oil fog to a minimum. The valves produce a round spray pattern.

Each spray valve is equipped with two needle valves. One controls air flow and the other oil flow. Multiple spray valves in gang-mounted design can be used for many applications. Each valve may be adjusted individually or shut off without disturbing the performance of others.

The valves can be had in two styles —one with the nozzle mounted directly on the valve and the second with the nozzle mounted at a remote point. **Write or call: Oil-Rite Corp., 2342 Waldo Boulevard, Manitowoc, Wis., for details on pneumatic spray system.**

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STAINLESS—PIPE • TUBING • SHEETS • PLATES • BARS, ETC.
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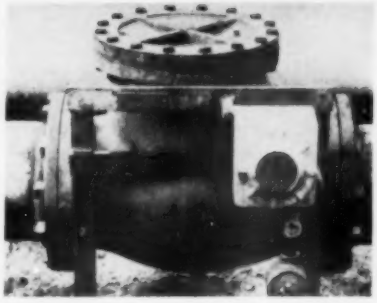


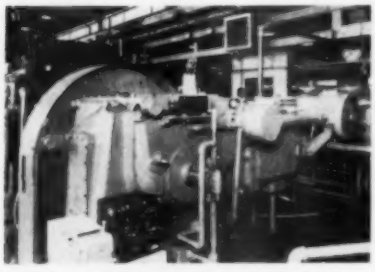
Automatic Control Regulates Number of Pumps

A simple and positive method of controlling one, two, three, or more pumps supplying a liquid product is offered by this new flow-actuated control, the maker reports. The pumps are started automatically and stopped as the flow requirements increase or decrease.

The operation of pumps controlled by the unit makes a mechanical means for obtaining predetermined rates of flow automatically.

Before the first pump reaches full capacity, the control unit starts the second pump. As the first and second pumps reach their full capacity output, the second and third pumps start. This procedure reportedly can be continued for any number of pumps until the desired output is reached.

As valves are closed and the demand for product decreases, the control unit shuts off the pumps corresponding to the decreased demand. This process of synchronizing capacity and demand is said to be followed automatically from no demand to full demand. **Write or call: Flow-Actuated Control Co., Inc., 101 W. Palisade Avenue, Englewood, N. J., for details on automatic flow control.**



Expansion Engine For Gas Liquefaction

An ability to handle temperature as low as —300° F. is provided by this new expansion engine for gas-liquefaction service, according to the maker. It's designed to handle inlet pressures up to 3,000 psig. The expansion engine reportedly meets the requirements for industrial refrigeration, liquefaction of

gases, and separation of gases by liquefaction.

A reciprocating piston type of machine, the engine generates shaft horsepower as a useful byproduct. It converts the energy of gas expansion through a piston, cylinder, and crankshaft. And it can be coupled directly to a compressor drive shaft, electrical generator, or a brake. An air flow of 250 lb. per minute at an inlet pressure of 3,000 psig. And an outlet pressure of 250 psig. develops over 200 b.hp. at the crankshaft. Regulation of air or gas capacity can be controlled easily.

Called the JX-14 the expander engine operates in conjunction with either centrifugal or reciprocating compressors. **Write or call: Cooper-Bessemer Corp., Mount Vernon, Ohio, for details on JX-14 expander engine.**

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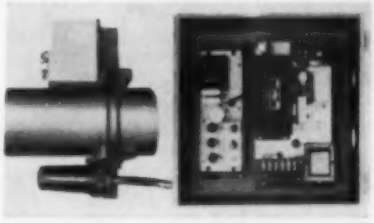


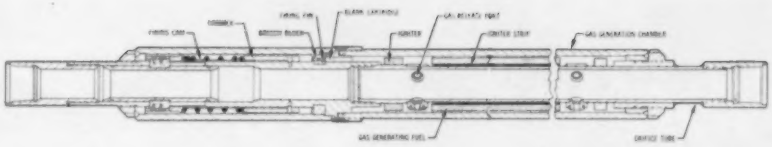
Controller Doesn't Contact Process Material

This new JSP-173A density and gravity controller is said to offer a new concept in controlling density and gravity of any process material passing through a pipe—either vertically or horizontally. No part of the equipment comes in contact with the process materials. As a result, the instrument cannot be affected by even the most corrosive materials, the maker points out.

It requires no drilling of holes or welding of brackets. And it can be removed easily for use in another location when desired.

Originally developed in cooperation with the Atomic Energy Commission, this type of equipment is said to have been used with outstanding success on government projects. When used with a satisfactory controller, it will provide accurate control of density or gravity within close limits.

When used with a recorder, it will indicate changes in gravity, interface level of different materials, and solids content in liquids from 1 to 25 per cent. Recording and controlling devices can be located up to 2,000 ft. from the material gaging point. **Write or call: Instruments, Inc., 122 North Madison, Tulsa, Okla., for JSP Bulletin.**



Fracturing Tool Generates Up to 5,000 Hp.

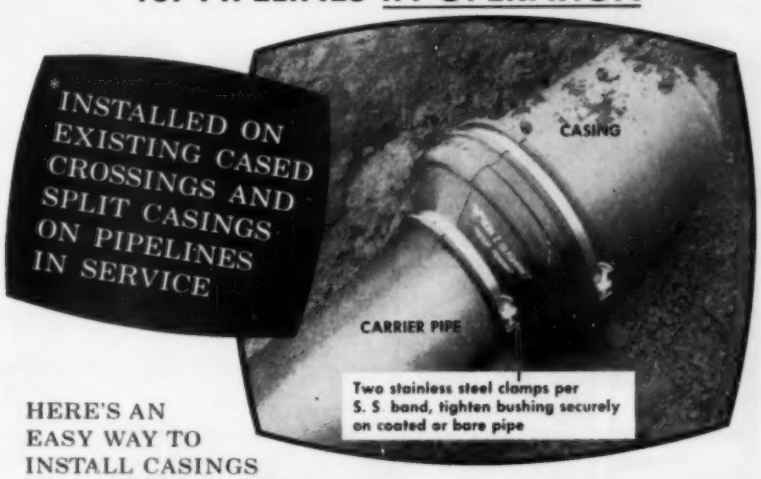
Here's a new down-hole fracturing tool which generates up to 5,000 hydraulic horsepower for high-injection fracturing, the maker reports. Called the Frac-Assist, it is a packaged power unit which is located in the tubing string through which the fracturing fluid is pumped.

The tool is located immediately above the perforated tubing opposite the zone or zones to be fractured. Normal fracturing procedures are followed at the

They Go Together...

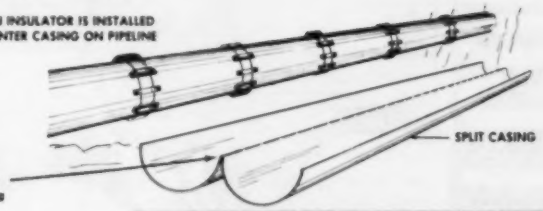
WmSEAL SPLICED "Z" BUSHINGS* for PIPELINES IN OPERATION

*INSTALLED ON EXISTING CASED CROSSINGS AND SPLIT CASINGS ON PIPELINES IN SERVICE



HERE'S AN EASY WAY TO INSTALL CASINGS ON LINES IN SERVICE

EVERY OTHER WmSON INSULATOR IS INSTALLED UP-SIDE-DOWN TO CENTER CASING ON PIPELINE



Interrupted torch-cut forms "hinge"—makes lineup easy for welding around pipe

Improved spliced "Z" Bushings are complete with easy to apply cold patch kit.

Write for bulletin

T.D. Williamson, Inc.

P. O. BOX 4038 TULSA 9, OKLAHOMA

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New Equipment

start, with force supplied by surface pump trucks which pump fluid through the tool.

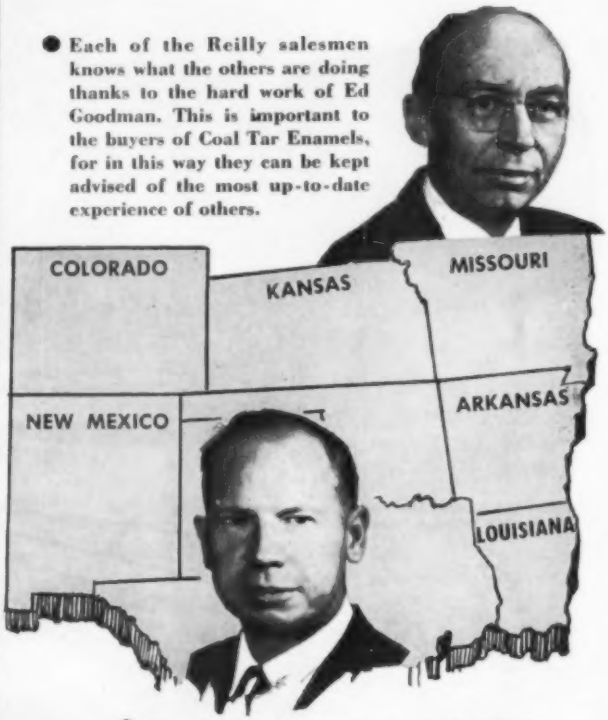
After the surface-pumped force has reached the zone to be fractured, it is assisted or boosted by triggering the Frac-Assist tool. This is accomplished from the surface by introducing a triggering plug into the fluid stream.

When the plug enters the tool, it compresses a firing cam and detonates blank cartridges which initiate a controlled burning of a gas-generating fuel. The gas exerts a strong, nearly instantaneous, downward force behind the fracturing fluid already in the tubing. This force reportedly creates multiple, productive fractures which are maintained and extended by the normal uninterrupted pumping flow which is continued. **Write or call: Byron Jackson Service, Inc., 6505 Paramount Blvd., Long Beach 5, Calif., for details on Frac-Assist tool.**

WHEN IT COMES TO SERVICE

COME TO REILLY

● Each of the Reilly salesmen knows what the others are doing thanks to the hard work of Ed Goodman. This is important to the buyers of Coal Tar Enamels, for in this way they can be kept advised of the most up-to-date experience of others.

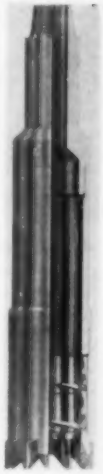


● Ernie Rouland enjoys the goodwill of Reilly customers because he carries out the Company's mission of supplying high quality products and comprehensive service. For Reilly Coal Tar Enamel, Ernie will be proud to have you call him.

Reilly COAL TAR PRODUCTS

Reilly Tar & Chemical Corporation
MERCHANTS BANK BUILDING, INDIANAPOLIS 4, INDIANA
Sales Offices in Principal Cities
P.O. Box 370, Granite City, Illinois

Junk Basket May Speed Fishing Operation



Fishing can be a simple one-trip operation with this Bowen-Itco junk basket, the maker says. The junk basket is said to be a rugged two-catcher fishing-and-coring device.

It uses either a mill type or a flat-bottom type of shoe in connection with two sets of free-revolving finger type of catchers. According to the company, the tool will catch all kinds of junk which might be broken off or dropped in the hole, including such irregular objects as rock-bit cones, broken slips, bits of wire rope, hand tools, and slivers and debris from twisted-off drill strings. In fact, any short, irregular ferrous or nonferrous object which might be found in a well can be caught and retrieved with the junk basket, the maker says.

It also may be used efficiently for taking core samples, drilling full-gage holes, and reaming. Shoes for the tool can be furnished dressed with sintered carbides. **Write or call: Bowen-Itco, P. O. Box 4587, Houston 13, Tex., for details on junk basket.**

●

Studding Outlets Available in Many Sizes

These accurately machined Moorlane studding outlets are available in a full range of sizes for all A.S.A. pressure ratings. According to company officials, the studding outlets are compact in design and require no outside reinforcement.

They are attached to vessels by external and internal fillet welds as shown on page 51 of the A.S.M.E. Code Section VIII, Fig. UW-16.1 (t), 1956 edition.

Normally, 12-in. and other nominal sizes will be shipped within 10 days from receipt of order. **Write or call: Moorlane Co., Box 1679, Tulsa, Okla., for details on studding outlets.**

THE TAYLOR SPIRAL WELD PIPE shown here was purchased by the El Paso Natural Gas Company and is now in use in gas-gathering systems. In applications of this kind where 14" or larger pipe is required, Taylor Forge recommends the use of pipe built with USS MAN-TEN high strength steel.

Taylor Forge uses USS MAN-TEN High Strength Steel

to produce stronger, lighter Spiral Weld Pipe to get more pipe footage from each ton of steel

TAYLOR FORGE & PIPE WORKS, Chicago, Illinois, uses USS MAN-TEN high strength steel for much of the Spiral Weld Pipe they produce. There are many reasons for this choice. As one of Taylor's engineers says, "Where pressure requirements call for wall thickness in excess of that required for structural strength alone, the higher strength of MAN-TEN steel permits the use of relatively lighter wall thickness. This in turn results in economies in field welding, freight, handling and stringing costs."

Although the original cost of USS MAN-TEN steel is slightly higher than carbon steel, the use of thinner wall pipe keeps the cost comparison favorable. A 20% weight saving is considered to be the break-even point, and savings in weight of 30% can readily be achieved. This picture improves still more when you consider that it is possible to produce 21% more pipe footage from one ton of USS MAN-TEN steel than from a ton of carbon steel.

The use of USS MAN-TEN high strength steel also increases the possible applications of Taylor Spiral Weld Pipe in any given pipe thickness. In pressure application, such as water and gas-gathering lines and penstocks, MAN-TEN steel's higher strength extends the range of a given shell thickness. The superior abrasion and corrosion resistance of USS MAN-TEN steel assures longer pipe life in dredging use.

USS MAN-TEN high strength steel has a 50% higher yield point than carbon steel. It has better atmospheric corrosion resistance, offers greater resistance to wear, fatigue, and impact. It can be used to maintain strength, while reducing weight, and at the same time offers enhanced resistance to abrasion.

NOW AVAILABLE. Our "Design Manual for High Strength Steels" contains comprehensive and practical information that you will find extremely useful in designing your product for greater economy and efficiency through sound use of high strength steels. For your free copy, write on your company letterhead, giving your title or department, to United States Steel Corporation, Room 2801, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

United States Steel Corporation, Pittsburgh • American Steel & Wire Division, Cleveland • Columbia-Geneva Steel Division, San Francisco
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USS HIGH STRENGTH STEELS

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UNITED STATES STEEL

Campbell Chain

GOES BIG WITH ANY RIG!

"Measure-Mark" Chain

CAM-ALLOY and CAMPBELL HIGH TEST STEEL

Exactly marked every 5'. Color-coded for instant grade identification. Standard footage in every pack—color-coded labels with inventory control. **Cam-Alloy** features *extremely* high tensile strength—excellent resistance to wear—light weight for given load. Look for the *orange* "Measure-Mark." Campbell **High Test** Steel Chain is high-carbon steel, heat-treated for high tensile strength and maximum resistance to abrasion. Short links give maximum flexibility. Look for the *blue* "Measure-Mark."

BOOMER CHAINS

Made from Cam-Alloy or High Test Steel Chain with Grab Hook each end, 20 feet long. Supplied bright finish. Packed one chain in cloth bag. In dimensions and weights for every job.

WINCH LINE CHAINS

Made from High Test Steel Chain, heat-treated for increased resistance to wear and shock loads. Tagged for size and length. Bright finish. In dimensions and weights for every job.

TRUCK TIRE CHAINS

Available in 3 grades: *Lug-Reinforced* for maximum traction and wear, *Mud-Service* for off-the-road use, *Highway Service* for general use . . . single pneumatic and dual triple.

CAMPBELL CHAIN CAMPBELL CHAIN *Company*

Factories and Offices: **York, Pa.—W. Burlington, Iowa**

WAREHOUSES: Campbell Chain Company, 712 "R" St., P.O. Box #1144, Sacramento, Calif.; 3085 N.W. Front St., Portland 10, Oregon; Wald Terminal Warehouse, 902 Live Oak, Houston, Texas.

WEST COAST SALES MANAGER: D. R. Coutts, 1933 Mission Ridge Road, Box 1175, Santa Barbara, Cal.

TERRITORY MANAGERS: J. N. Kuhl, 7000 S. Shore Drive Hotel, Chicago, Ill.; S. Hardison, 1970 Val Verde, Germantown, Tennessee; S. Adsit, 17 E. 57th St., Kansas City, Mo.; A. E. Vincent, 3917 Thaxton Ave., S.E., Albuquerque, N. Mex.; K. Steinmetz, 1339 Sherwood Road, Glenview, Ill.; D. A. Ruffin, 5623 Boaz St.—Apt. #90, Dallas 9, Texas; G. W. Ferree, 5634 Putnam Drive, Birmingham, Mich.

CONTACT ANY OF THE CAMPBELL REPRESENTATIVES ABOVE FOR COMPLETE INFORMATION ON *ANY* TYPE OF CHAIN—OR HELP WITH A PARTICULAR CHAIN PROBLEM.

SHOWCASE . . .

New Literature

Pipeline Gate Valves (Grove Seal-O-Ring) for 6 to 36 in. lines, available in A. S. A. Series 150 to 600 w.o.g., are the subject of new multicolor 12-page Bulletin G-571. Prepared as an engineering and specification reference, the bulletin contains: (1) complete dimension tables; (2) charts and graphs to determine venturi-valve flow rates with gas-flow correction for gravity, temperature, and supercompressibility; (3) photographs and drawings showing details of design, construction, testing, operational features, and valve types; and (4) material specifications. **Write or call: Grove Valve and Regulator Co., 6529 Hollis Street, Oakland 8, Calif., for Bulletin G-571.**

•

Catalytic Sweetening Process (Petreco-Bender) is the subject of this new four-page literature sheet. The process is described as a modern way to sweeten light hydrocarbons by converting mercaptans to disulfides through oxidation. The bulletin tells how the process works, expected throughput of the system, estimated cost of operation, and chemical requirements. By way of example, it points out that the process operates at about 80 per cent of the chemical cost of most conventional methods of sweetening, and at only 10 per cent of the operating cost of regular doctor treating. **Write or call: Petreco Div. Petrolite Corp., 3202 South Wayside Drive, Houston 1, Tex., for data sheet on Petreco-Bender sweetening process.**

•

Exhausters and Compressors Bulletin 4P (16 pages) describes the Schutte & Koerting line of single-nozzle and multinozzle water-jet exhausters, water-jet laboratory vacuum pumps, and barometric Hydro-Vac exhausters for pump priming, handling air, and evacuating vessels, and for mixing gases and liquids in continuous processes. The bulletin includes application, construction, and operation information on each type of exhauster. And it gives the sizes available and their dimensions. Capacity curves, capacity ratios, and water-consumption tables in the bulletin enable the reader to select the proper type and size exhauster to meet specific operating requirements. Pump-priming capacities for both single-nozzle and multinozzle exhausters are provided in easy-to-read tabular form. **Write or call: Schutte & Koerting Co., Dept. JA-31, Cornwells Heights, Bucks County, Pennsylvania, for Bulletin 4P.**

Gear-Driven Pumping Units Booklet. This new illustrated booklet (20 pages) contains operating data and detailed mechanical and structural descriptions of the Parkersburg pumping units. **Write or call: Parkersburg Rig & Reel Co., 3345 Winthrop Avenue, Fort Worth, Tex., for catalog on gear-driven pumping units.**

●

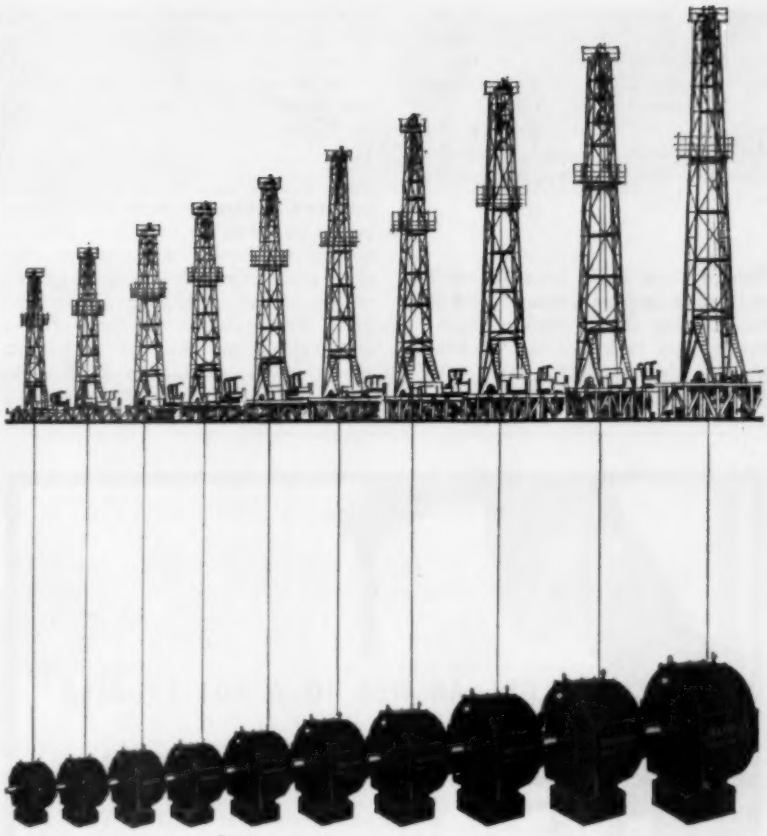
PVC Pipe Fittings and Flanges Booklet. Technical data and installation information on unplasticized polyvinyl chloride (PVC) pipe are provided in a new Tube Turns booklet. It also gives complete specifications for threaded and socket types of PVC fittings, valves, and flanges made of both normal and high-impact material. The booklet contains pressure-temperature charts, chemical-resistance tables, and support-spacing formulas. And it lists leading industrial organizations now using PVC piping. **Write or call: Tube Turns Plastics, Inc., 2929 Magazine Street, Louisville 11, Ky., for booklet on PVC pipe fittings.**

●

New Tool for Moisture Analysis is dealt with in this first issue of a new publication, "Tech-Talk." The tool is the Schlumberger nuclear magnetic resonance analyzer, Model 104, analytical instrument for quantitative measurement of hydrogenous liquids (water and oils) in solid materials. It is reported to be particularly suitable for rapid nondestructive measurement of moisture in granular or fibrous solids with high accuracy and reproducibility. Profusely illustrated, the six-page news letter explains nuclear magnetic resonance and describes in detail how the NMR analyzer operates. Illustrations include block diagrams, absorption curves, and calibration curves. **Write or call: Schlumberger Well Surveying Corp., Ridgefield, Conn., for "Tech-Talk." No. 1.**

●

Ripple Tray for the Process Industries is described in this new four-page brochure. The ripple tray was recently patented by Stone & Webster Engineering Corp. for use in petroleum refining and other processing. An outgrowth of many years of experimentation on tray dynamics and various contacting devices, the ripple tray is manufactured from light-gage sheet metal which is perforated and corrugated. In a distillation tower, both liquid downflow and vapor upflow occur through the perforations so that no downcomers are required, according to the brochure. The corrugations or waves in the ripple trays help redistribute liquid as it flows



National's family of torque converters takes care of oil field needs from 100 to 1000 HP

National Torque Converters have handled so many BIG jobs well that a lot of oil field men don't realize that units are available to handle *small* jobs, too.

The National line includes six sizes, classified according to the diameter of the hydraulic circuit. But this doesn't tell the real story of availability. The line also includes seventeen hydraulic circuits, which permit the converter to be accurately matched to the power and speed characteristics of the engine. This is a major reason for the high efficiency, top performance and enduring reliability that users report.

For new applications of from 100 to 1000 HP you can order National Torque Converters in selected sizes and circuits. You can order the converters "packaged" with the engines of most of the nation's leading engine builders. And as original equipment, you can specify National Torque Converters on Bethlehem, Brewster, Cardwell, Continental-Emsco, Ideco, Joy, National Supply, "Oilwell," Unit Rig or Wilson drilling rigs. For more information . . . write:

THE NATIONAL SUPPLY COMPANY

INDUSTRIAL PRODUCTS DIVISION

Two Gateway Center, Pittsburgh 22, Pa.

Pace-setters in the progress of industrial power transmission

from the bottom of the tray into the froth on the tray below in countercurrent contact with rising vapor. The brochure describes how tray efficiency is maintained over a wide range of loadings. **Write or call: Stone & Webster Engineering Corp., 49 Federal Street, Boston 7, Mass., for brochure on ripple tray.**

●

Floating Roof Tanks are described and pictured in 24-page Catalog 57 FR. The new catalog details various types of floating-roof tanks for storing volatile or corrosive products. The catalog clearly discusses and illustrates the construction features and functional advantages of each type of tank along with two types of floating-roof seals. **Write or call: Hammond Iron Works, 744 Broad Street, Newark 2, N. J., for Catalog 57 FR.**

●

Surface Condenser Bulletin M-571 (four pages) describes the new Sweco line of surface condensers designed for efficient production of vacuum for prime-mover service with large steam turbines. The surface condensers offer a delta-vee design based on long experience in the production of heat-exchange equipment for the petroleum and other fields. The bulletin, prepared in two colors, is well illustrated to show design and technical features. **Write or call: Southwestern Engineering Co., 4800 Santa Fe Avenue, Los Angeles 58, Calif., for Bulletin M-571.**

●

Spiral-Bevel Speed Reducers Catalog SB-517 (40 pages) contains design features, specifying and ordering information, selection tables, service factors and arrangements, dimensions, horsepower ratings and parts lists for Philadelphia Gear products. **Write or call: Philadelphia Gear Works, Inc., Erie Avenue and G. Street, Philadelphia 34, Pa., for speed-reducer Catalog SB-517.**

●

Direct-Burial oil-immerse earth-cooled transformers are covered in this new brochure. The transformers described are completely buried. The brochure includes test and performance data. **Write or call: Esco Mfg. Co., Box 1039, Greenville, Tex., for brochure on direct-burial transformer.**

●

V-Belt Engineering-Data Catalog. Titled "Dayton V-Belt Drives for Oil Field Drilling Rigs," new Catalog 340 gives for the drilling industry practical V-belt design recommendations based on actual drilling-operation requirements. The catalog offers preengineered drive tables, using every possible sheave combination for slush-pump service. Concise engineering data are provided to permit the design of drives for almost any drilling-rig V-belt application. The catalog lists new horsepower ratings based on recently developed knowledge of the unusual requirements of drilling-rig service. **Write or call: Dayton Rubber Co., 925 Slocum Street, Dallas, Tex., for Catalog 340.**

●

Pipeline Equipment. Titled "Pipelining," this new brochure, Form 32549, deals with Caterpillar pipelayers and hydraulic pipelaying attachments. It also explains the use of diesel engines as a power unit for such pipeline equipment as ditchers and arc welders. Two new pipeline tools, the D9-mounted Kelly ripper and tractor-mounted welders are also explained in terms of their savings to the pipeline contractor. The eight-page publication is illustrated. Pictures show pipeline equipment working on various jobs throughout the country. Complete specifications are given on the pipelayers along with explanations of their operational features. **Write or call: Caterpillar Tractor Co., Peoria, Ill., for Form 32549.**

COOL ANSWER TO A HOT PROBLEM
R & M "All-Weather-40" MOTORS
Because excessive heat shortens motor life and seriously reduces the effectiveness of lubrication, R&M "All-Weather-40" motors are designed to run cooler . . . even in the blazing sun! High velocity clean-sweep ventilation between the frame and windings prevents the sun's rays from adding appreciable internal heat. Under severest conditions, heat rise never exceeds 40° C.
Get complete information now on cooler-running R&M "All-Weather-40" motors. Write for Bulletin 3019-DGJ or call your R&M representative.
ROBBINS & MYERS, INC.
Motor Division
Springfield, Ohio

Engineering Progress Report
FROM UNION CARBIDE CHEMICALS COMPANY

Glycol Dehydrators give 90°F. Dew Point Depressions...

Improved regeneration systems give high glycol concentrations

There are two methods commonly used today to dehydrate natural gas: one employs glycols; the other, dry desiccants. Most authorities agree that glycol systems are less expensive in both initial and operating costs. Recent engineering advances now permit dew point depressions up to 90°F. with economical glycol-type dehydrators. Union Carbide Chemicals Company maintains an extensive engineering service group designed to help the natural gas industry obtain the best possible dehydration service with CARBIDE's diethylene glycol and triethylene glycol.

A GRADUAL IMPROVEMENT

Diethylene glycol was first used to dehydrate natural gas in 1936 and by 1939 sixteen glycol type plants were in service providing average dew point depressions in the range of 40°F. Triethylene glycol was first used to dehydrate natural gas in 1949. The dew point depressions realized with glycol type plants have gradually increased until today the standard guarantee is a 65°F. depression or gas containing seven pounds of water per MMSCF, whichever first occurs. For sometime now, some equipment manufacturers have offered a 75°F. dew point depression guarantee.

FACTORS INFLUENCING DEW POINT DEPRESSION

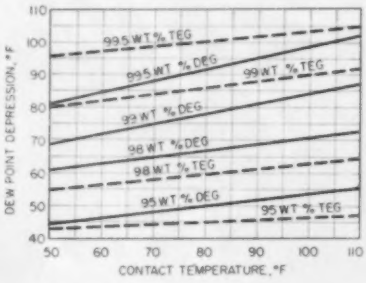
The dew-point depression obtained with a glycol dehydration plant depends upon several factors, such as:

1. Concentration of water in the lean glycol solution.
2. Glycol circulation rate.
3. Contact temperature in the top of the absorber column.
4. Efficiency of gas to glycol contact in the absorber.

Even with conservative design and operation, however, the dew point of the gas leaving the glycol contactor cannot be lower than the equilibrium value for the conditions of temperature and glycol concentration found on the top plate.

HIGH GLYCOL CONCENTRATIONS

The high diethylene and triethylene glycol concentrations now being obtained in plant practice, prompted studies to determine the dew point depressions obtainable with such solutions.



These data indicate that both diethylene and triethylene glycol at 99.5 per cent concentrations provide dew-point depressions in the 80°-105°F. range.

At concentrations of 98 per cent and lower, diethylene glycol provides better depressions than equal concentrations of triethylene glycol, while at 99 and 99.5 per cent concentrations, triethylene glycol appears to allow a 5°-10°F. lower dew point than diethylene glycol.

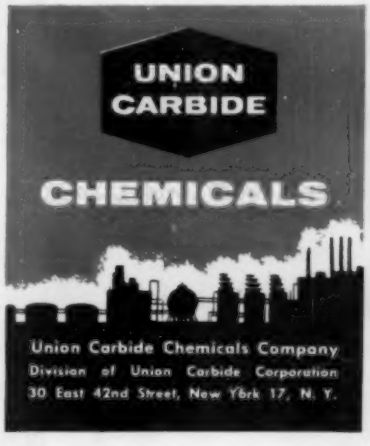
90°F. DEPRESSION MEETS TRANSMISSION REQUIREMENTS

Glycol regeneration equipment on the market today is capable of producing and maintaining glycol concentrations above 99%. Thus, it is possible for equipment manufacturers to guarantee a 90°F. minimum dew point depression. There are very few instances where a 90°F. depression will not meet the water content specifications of any long distance gas transmission company.

CARBIDE'S RESEARCH PROGRAM

Dew point depression studies are but one phase of CARBIDE's extensive research activities designed to improve the products and processes of the natural gas treating industry. CARBIDE's Technical Service Department stands ready to help you obtain the best possible results from your gas treating installations. For more information on the use of CARBIDE's glycols for gas dehydration, call the nearest CARBIDE technical representative or write, Union Carbide Chemicals Company, Department B, 30 East 42nd Street, New York 17, N. Y.

"Union Carbide" is a registered trade-mark of Union Carbide Corporation



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Huntington Beach
Long Beach
Santa Fe Springs
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Taft
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CANADA
Dawson Creek
Drayton Valley
Edmonton
Estevan
Lloydminster
Red Deer
Virden

COLORADO
Artesia
Sterling

ILLINOIS
Salem

INDIANA
New Harmony

KANSAS
El Dorado
Ellinwood
Liberal
Pratt
Russell

KENTUCKY
Henderson

LOUISIANA
Eunice
Harvey
Houma
Jena
Lake Charles
Morgan City
Morgan City Parts Depot
New Iberia
Shreveport

NEBRASKA
Kimball

NEW MEXICO
Farmington
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Tatum

NORTH DAKOTA
Williston

OKLAHOMA
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For Complete Drilling Harmony Go

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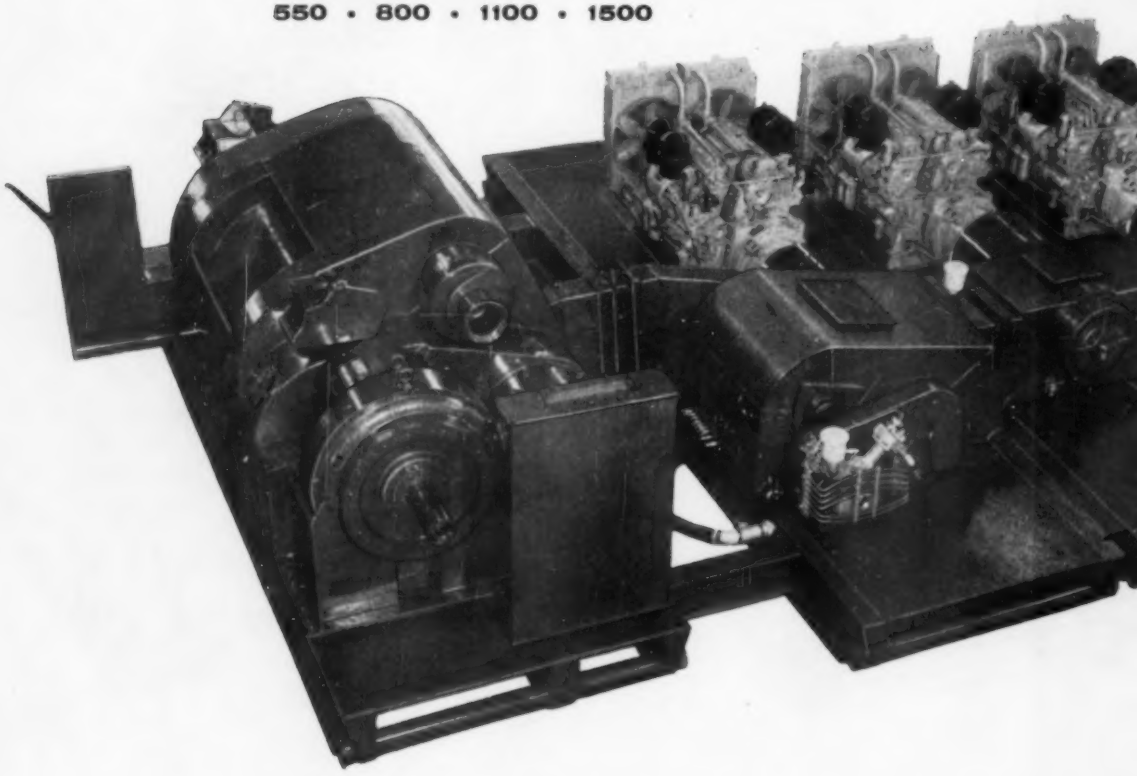
Here's the Series of Rigs
That Gives Contractors the Adaptability a
Bi

Continental-Emsco's A-Series Rigs

Built in 4 Sizes . . to Fit All Drilling Conditions

550 • 800 • 1100 • 1500



Equipment

Lift Here . .
Take a BIG Look
Then see last pages

BUY WHAT YOU NEED NOW . . ADD W

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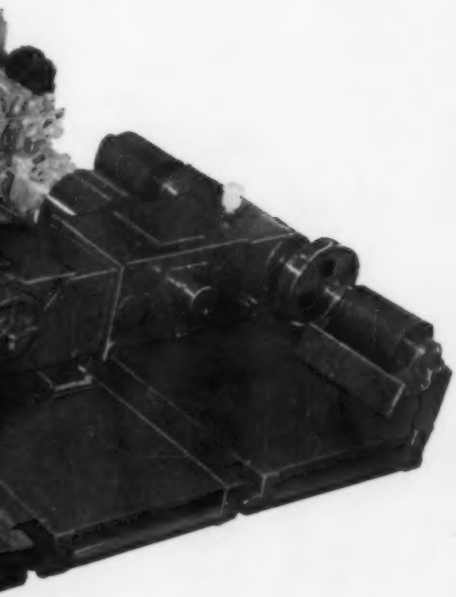
and Versatility to
Bid and Get Jobs!



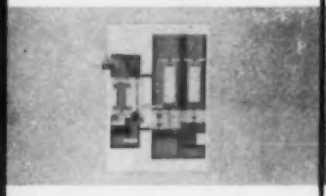
POWER ADAPTABILITY

Wider power range for any drilling condition

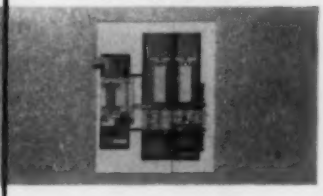
The A-Series rig is powered by your selection of two, three or four engines to meet your power needs for all kinds and depths of drilling. Pump drives may be had in any combination up to four. You can start with a two-engine hook-up and add one or two more engines as you need them . . in the field, without excessive modification costs. Rigs are available in either flat-set or step-set.

Thoroughly field proven under drilling conditions the world over . . the A-Series rig is now operating in the United States, Alaska, Canada, Venezuela, Algeria and Pakistan.

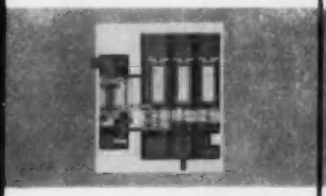
Two-engine power end with one side pump drive



Two-engine power end with rear pump drives



Three-engine power end with two side pump drives



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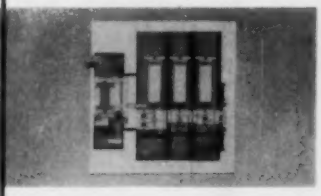
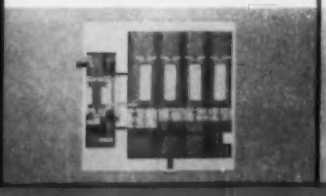


Four-engine power end with two side pump drives



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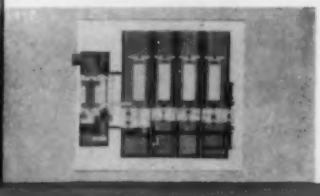

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Ask Your Continental-Emsco Man to Show You the

A-Series Rig Demonstrator

You can quickly see and determine the combination of engines and drives to fit your needs.

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That Gives Contractors the Adaptability a
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Built in 4 Sizes . . to Fit All Drilling Conditions

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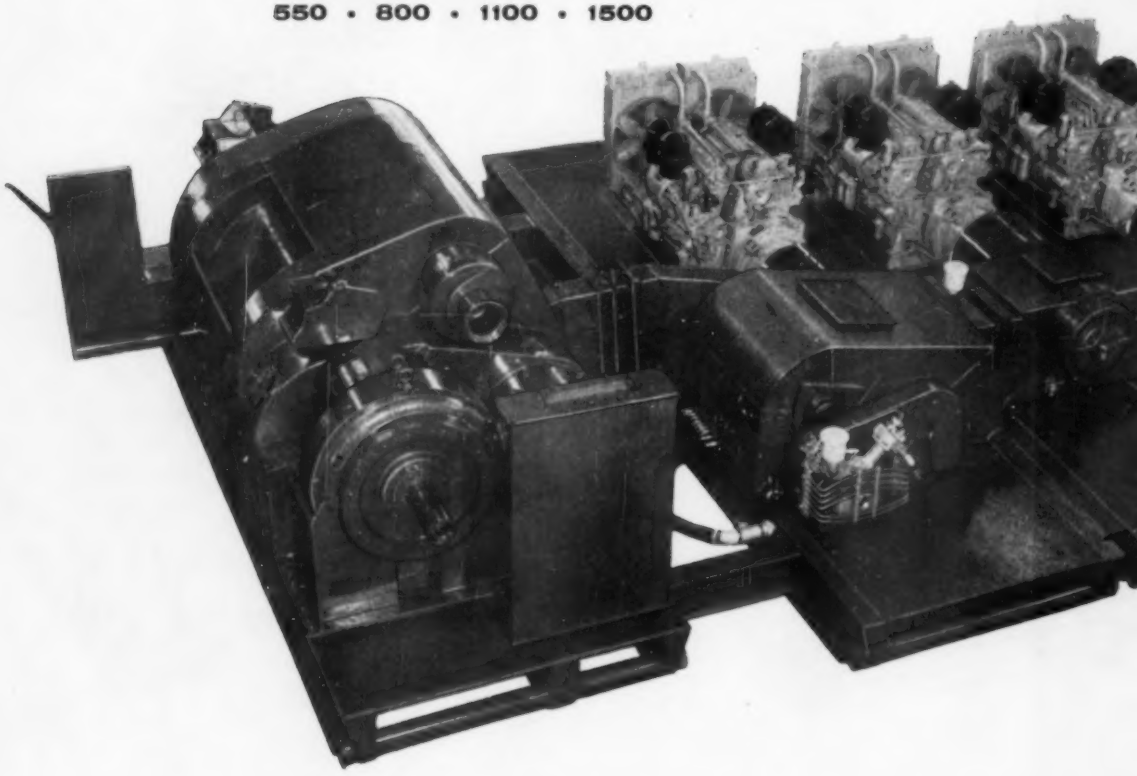

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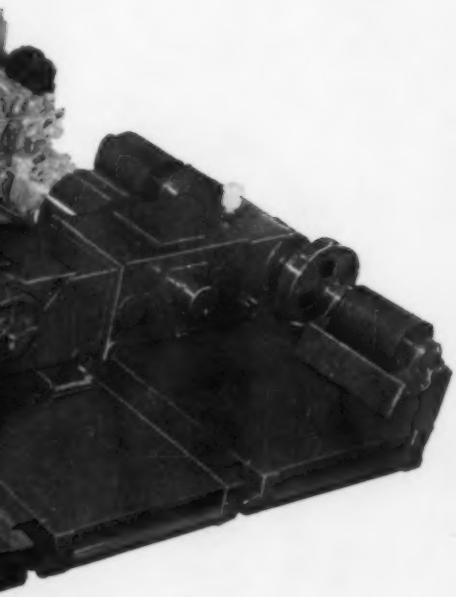

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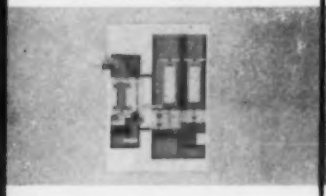
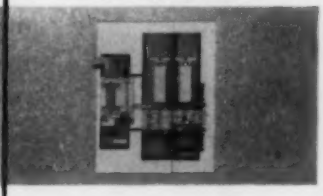
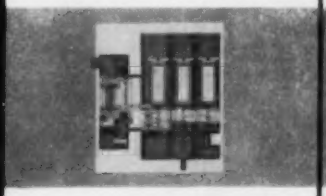
Two-engine power end with one side pump drive



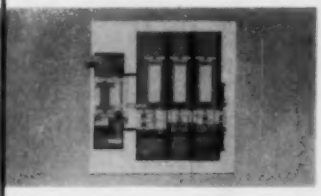
Two-engine power end with rear pump drives



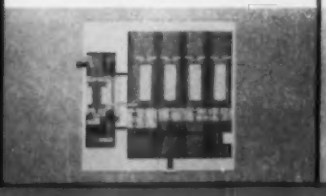
Three-engine power end with two side pump drives



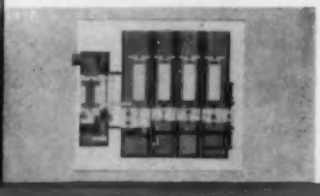
Three-engine power end with rear pump drives



Four-engine power end with two side pump drives



Four-engine power end with rear pump drives



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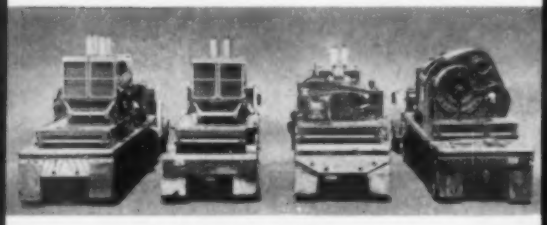

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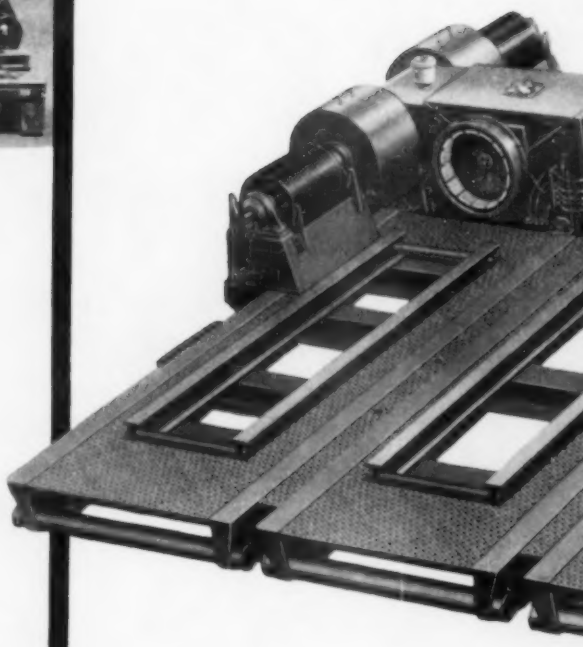

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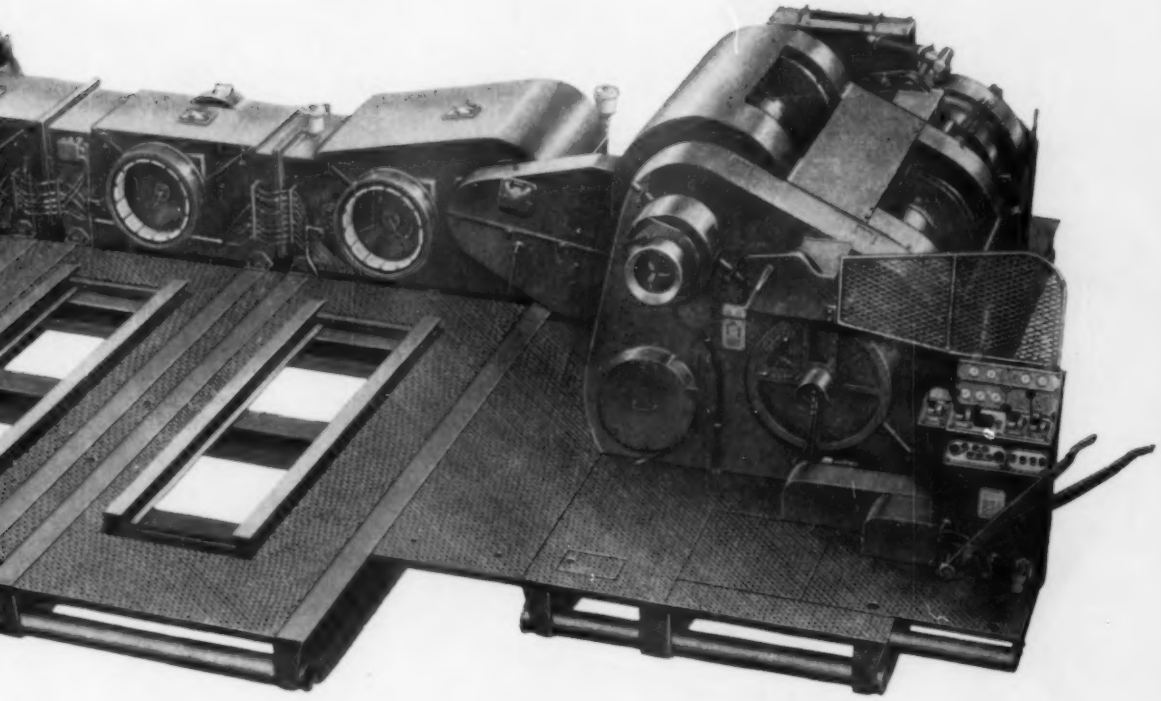
in operation day after day . . year after year



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EQUIPMENT MEN . . . in the News

Tretolite Names Siess Assistant Sales Manager

C. P. SIESS

Charles P. Siess, Jr., formerly assistant division manager at Anaco, Venezuela, for South American Petrolite Corp., has been appointed assistant to James E. Stockton, Jr., general sales manager for Tretolite Co., division of Petrolite Corp., and now is located in the St. Louis home office.

Siess served 4 years with the company as field engineer specializing in corrosion problems in Arkansas, North Louisiana, Miss'ssippi, and East Texas. In South America he worked both in the production and the refining phase of the industry. Besides covering part of the Maracaibo region, Siess also covered the Trinidad area.

Elgen Opens New Offices, Announces Appointments

Norman Williams has been named as head of the perforating division in the Dallas main offices of Elgen Corp. In addition to the Shreveport office where Ernie Young has been assigned as manager and Custer Sokolosky as sales representative, Elgen has announced two new off ces to serve the Gulf Coast area. In Natchez, Miss., Dick Heard has been appointed manager, and in Thibodeaux, La., John Yerger holds the same post. Another office in El Dorado, Ark., has been opened with Max Mitchell assigned as manager.

Jim Moore has been named as new manager of perforating operations in Wichita Falls, Tex. Charles Franklin and Cliff Strozier have been appointed as sales representatives in Seymour, Tex., and Tulsa, respectively.

Caterpillar Begins Work On Industrial Engine Plant

Construction of a new 500,000-sq. ft. industrial engine plant for Caterpillar Tractor Co. began recently when the company's president, Harmon S. Eberhard, moved the first bulldozer bladeful of earth on the plant's site north of Peoria, Ill. The engine plant will be the first of three facilities built in the 1,100-acre area, with a multi-building research center and a general offices building slated for future construction. Also present to mark the beginning of work was H. H. Howard, vice president in charge of Caterpillar's engine division.

The new industrial engine plant will be completed by early 1959 and will manufacture the company's two largest engine models, the D397 and the D375. In addition, the plant will be the assembly point for industrial engine arrangements of other engines in the Caterpillar line. Design and manufacture of all special industrial engine attachments will also be carried on in the new engine plant. Manufacture of the remainder of the Caterpillar engine line will continue in the company's Peoria plant.

Bastian-Blessing Names Engstrom to New Post

Ralph H. Engstrom has been named assistant vice president in charge of sales for the RegO division of Bastian-Blessing Co. of Chicago. The office of assistant vice president has been newly created as a part of the general expansion of the RegO division.

Engstrom moves up from his post as sales manager of the division, a position he had held since 1951.

Hessin Named Sales Engineer by Granberg

W. J. Hessin has been appointed sales engineer for Granberg Corp., according to J. R. Murphey, sales manager of the Oakland, Calif., firm. Hessin's new duties will be coordinating engineering and sales department functions for the company's complete line of Granco positive displacement pumps, meters and accessories. He will work in Granberg's headquarters at Oakland.

Hessin has had 18 years experience in design, engineering sales, service and operating engineering before joining the Granberg organization.

Wolverine Promotes Smith To Newly Created Post

A new administrative post has been created within the sales division of Wolverine Tube, division of Calumet & Hecla, Inc., and Jack H. Smith has been appointed manager of districts, according to John Dumser, director of sales.

Smith, with the company since 1940, for the past 5 years has been manager of Wolverine's East Central sales district. He has served in a wide variety of sales capacities with Wolverine. As manager of districts, Smith will coordinate the activities of all Wolverine's sales districts responsible for marketing the firm's copper, copper base alloy and aluminum tubular products. He will make his headquarters at its general sales offices in Detroit.

J&L Opens Supply Store to Serve Panhandle Area

Jones & Laughlin Supply Division has opened a new oil-field supply store in the Panhandle sales district, according to Rainey Elliott, president of the division. The newly constructed store located at Liberal, Kans., houses two offices and a warehouse.

J. J. Crawford, formerly manager of the firm's Edmonton, Alta., Canada store, has been appointed local store manager of the new store; S. J. Payne and E. J. Pierson have been assigned to the new location as sales representatives. Assisting Crawford in store operations are K. C. Sierer and R. C. Small.

The Liberal store will be under the over-all supervision of H. U. Everett, district sales manager, headquartered at Amarillo, Tex.

Stone & Webster Elects Argue, Ford as Directors

Fred W. Argue, vice president and engineering manager, and Edward J. Ford, vice president and senior construction manager, of Stone & Webster Engineering Corp. have been elected directors of the firm.

Argue, whose office is in Boston, joined Stone & Webster in 1941 as a

F. W. ARGUE

E. J. FORD

power engineer. He became assistant engineering manager in 1952, engineering manager in 1954 and was elected a vice president in 1955.

Ford, whose office is in New York, joined the firm in 1923. He has served as electrical superintendent on Stone & Webster work at the Oak Ridge atomic plant, assistant superintendent on construction in Saudi Arabia and from 1948 to 1954 was general superintendent for construction work on Gulf States Utilities Co. properties in Texas and Louisiana. He was made senior construction manager in 1955 and elected a vice president in 1956.

Oilwell Transfers Boring, Hipp Named Representative

George A. Boring, field representative for United States Steel's Oil Well Supply Division at Odessa, Tex., has been transferred to Kermit, Tex. Wornock Hipp, Jr. has been named field representative at Hobbs, N. M., according to William Miskimins, Central Midwest area manager of the division.

Boring was employed by the division at Odessa in 1955 and was named field representative at this location in April 1957. Hipp was employed at Hobbs in 1951.

Dow Promotes Ballman, Dixon to New Sales Posts

Donald K. Ballman, general sales manager of The Dow Chemical Co. has been promoted to director of sales, according to President Leland I. Doan. He succeeds Donald Williams who recently was appointed director of corporate relations. William R. Dixon has been promoted to general sales manager. Dixon has been assistant general sales manager since 1951.

Ballman has been active in both sales and sales development since he joined the company in 1935. His interest in product development led to the formation of the company's technical service and development group in 1943 under his supervision. In 1945 he was named assistant general sales manager.

Dixon has been with the company since 1936, beginning in the cellulose products division. He was assigned to the New York office in 1939 as the company's first branch office salesman in the plastics field. He returned to Midland headquarters in 1941. He was appointed assistant sales manager of the plastics department in 1943.

Herb J. Hawthorne Names Thigpen as Sales Manager

Jack W. Thigpen, former administrative assistant, has been promoted to sales manager at Herb J. Hawthorne, Inc., Houston, manufacturers of Blue Demon replaceable blade drilling bits.

J. W. THIGPEN

Thigpen spent 10 years in petroleum reservoir engineering services through-

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out the Southwest, in supervisory and management positions, before joining Herb J. Hawthorne as administrative assistant in 1955.

Announcement of Thigpen's appointment was made by R. M. Thornton, Jr., company president, as part of the current expansion program which includes new construction at the company's Houston headquarters.

An additional 5,700 sq. ft. of new office area have been added to expand sales and engineering facilities and increase the company's product research division. Another 7,200 sq. ft. have been added to the shipping and warehouse areas to release plant area to expand the product inspection department.

Marsh Instrument Appoints Barnett as Sales Manager

Robert E. Barnett has been appointed sales manager of Marsh Instrument Co. and affiliates. He joined the Marsh sales staff in 1941 and was appointed assistant sales manager in 1950.

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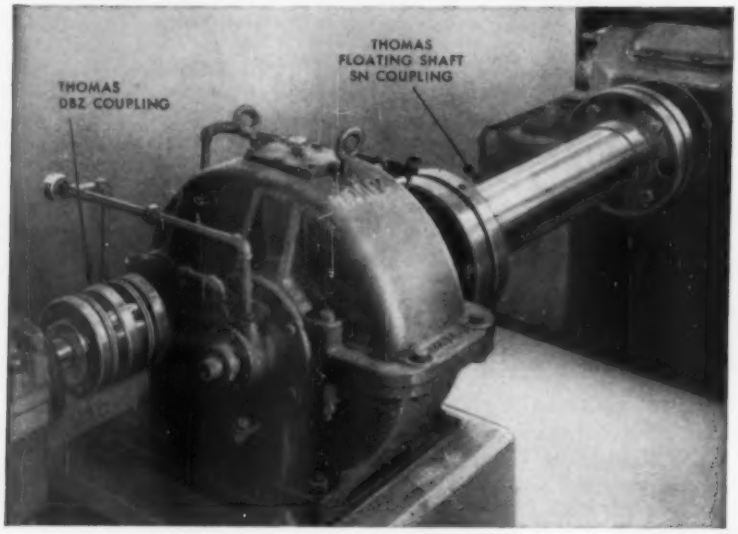

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Robell Joins Badger's Sales Engineering Staff

JOHN ROBELL

John Robell has joined the sales engineering staff of Badger Manufacturing Co., Cambridge, Mass. He will be located in Badger's Cambridge office, according to William Rousseau, vice president of the firm. Robell has 25 years research and development experience in the U.S. and abroad. He is recognized as an authority in the development of process improvements for synthetic ammonia, methanol, synthesis gas, hydrazine, urea and other chemicals. He is credited with several patents in inorganic chemistry and process equipment and pioneered in the development of flame reactions.

In addition to management and engineering responsibilities in the U.S., Robell has investigated plants in Germany for the U. S. Government and plants in France, Belgium, Holland and South America.

American Iron Appoints Exclusive Trinidad Agent

American Iron & Machine Works Co., Inc. has announced the appointment of Masons & Co., Ltd., Port of Spain, B.W.I., as its exclusive agent in Trinidad.

John Rooks, representing Masons & Co., Ltd., recently spent 10 days at the main offices and plants of American Iron in Oklahoma City to observe the latest manufacturing techniques on oilfield equipment by this company.

W. R. Wheeler, Jr. (right), sales manager of American Iron, points out to John Rooks a part of the large export shipment of oil-field drilling tools that are daily shipped to all parts of the world.

Hercules Tool Appoints Gulf Coast Representative

The Leland Hamner Co. of Houston has been appointed Gulf Coast representative for Hercules Tool Co., Tulsa, covering the Southwest and Gulf Coast areas of Texas and southern Louisiana. Leland Hamner Co. has representatives in Corpus Christi, Tex., Lafayette and Houma, La., as well as in Houston.

As a result of this appointment, drillers and producers in the Gulf Coast area will be able to secure Hercules products from supply stores in the near future.

Hycon Aerial Surveys Names Perley as Vice Pres.

R. H. PERLEY

Richard H. Perley has been appointed vice president and general manager of Hycon Aerial Surveys, Inc., according to Trevor Gardner, president and chairman of the Pasadena, Calif., firm. Perley, who has been with Hycon for the past 7 years, recently headed the customer services division. Previously, he served as manager of the Hycon photographic products division. Perley joined Hycon in 1950 as contract administrator.

Hycon Aerial Surveys, Inc. performs both photographic and geophysical surveys with a fleet of eleven P-38s and Super Cessna aircraft. Hycon has photogrammetric and geophysical data reduction facilities in Pasadena.

SEG Awards University Scholarships in Geophysics

The second annual award of university scholarships in geophysics has been made by the Society of Exploration Geophysicists, according to Roy F. Bennett, foreign exploration manager of Sohio Petroleum Co. of Oklahoma City, and president of the society. Bennett said there will be 13 scholarships granted by individual companies interested in the geophysical profession, and one scholarship financed by the organization's general fund. The 1957-58 educational grants will total $12,125 and will be taken in nine universities.

Companies granting scholarships are Grant Body & Equipment Co., Tulsa; Mayhew Supply Co., Griffin Tank & Welding Service, and Geophysical Service, Inc., all of Dallas; Texas Gulf Sulphur Co., Schlumberger Well Surveying Corp., Herb J. Hawthorne, Inc., Vector

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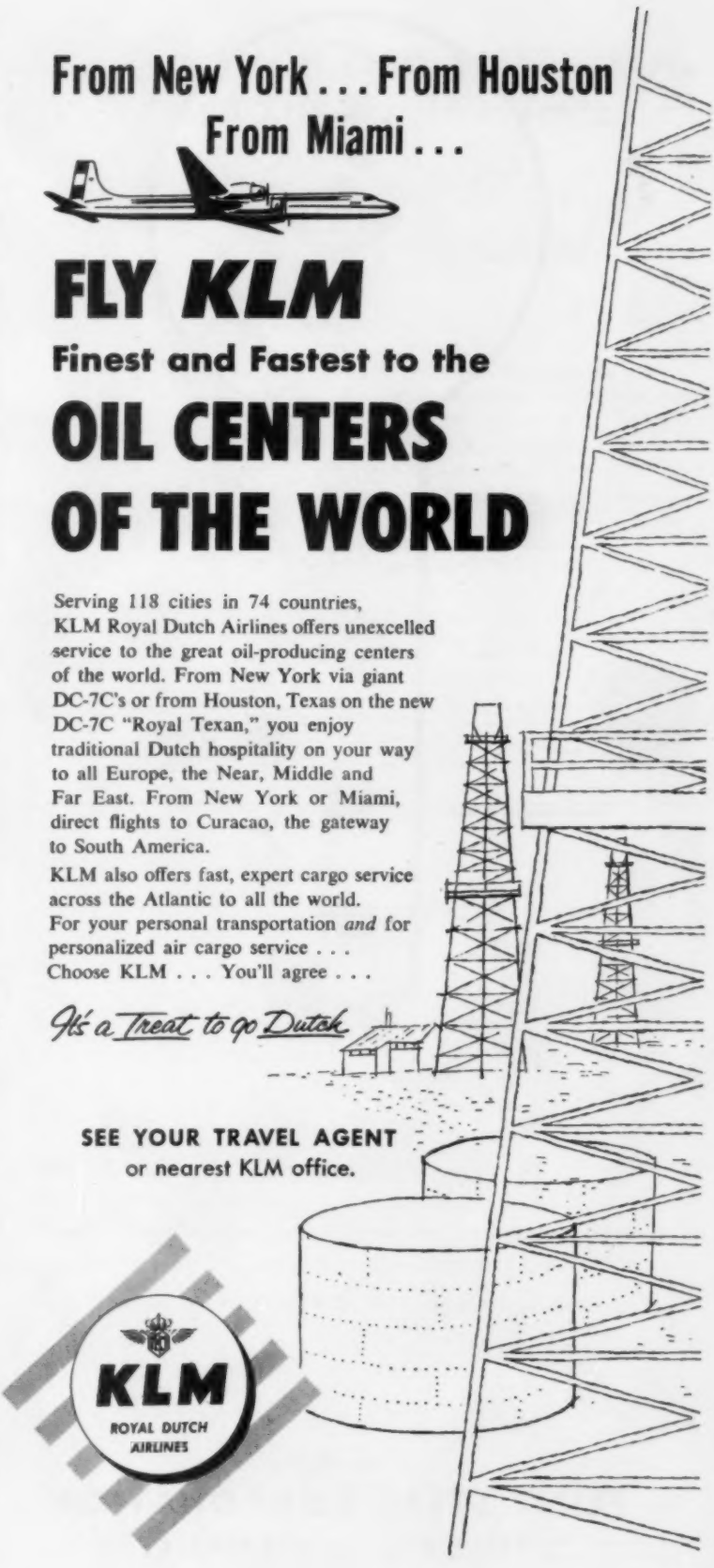

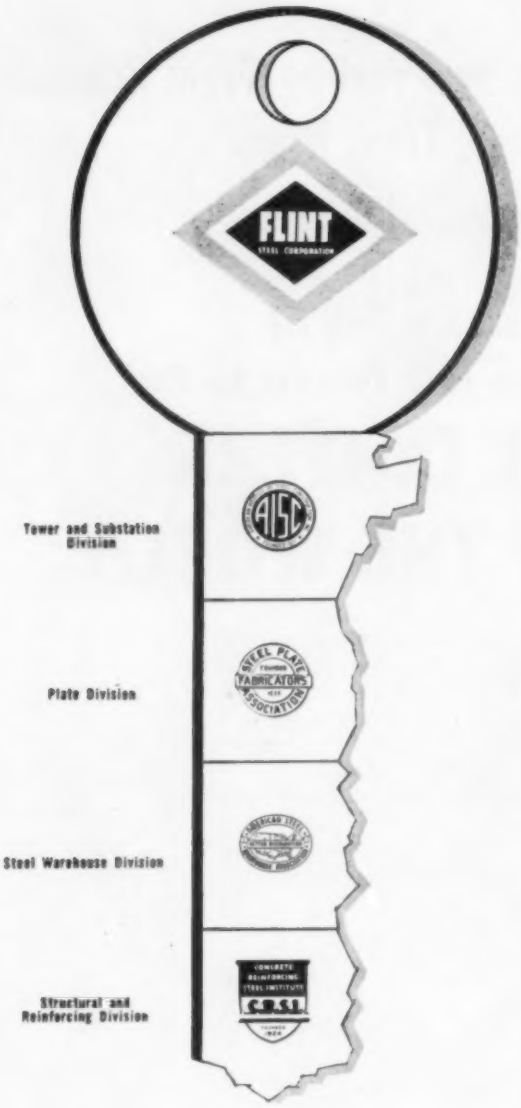

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BJ Names Koberg, Wood, Roberts to New Posts

E. R. Koberg, who was formerly district manager in New Orleans, is moving to Byron Jackson Tools, Inc.'s export department in Fort Worth as assistant manager, according to Garth Nicolson, vice president and general manager. Koberg has been with the company 13 years.

R. E. Wood has been appointed to the managership of the new Four Corners office-warehouse in Farmington, N. M. His operations will be under the jurisdiction of O. J. File, Rocky Mountain regional manager in Denver.

W. F. Roberts has been named district manager in Tulsa. He has been with Byron Jackson Tools, Inc. for 11 years. He was in the Los Angeles office until 1955 and worked as a salesman out of the Oklahoma City office until now.

National Rig Drills 110 Wells Without Repair

This rig owned by The Reserve Drilling Co., Great Bend, Kans., has drilled 110 wells, totaling over 325,000 ft. of hole, without a single major repair.

It is a National Type T-32 rig, with National C-150-B pump, purchased new in 1951. The rig is now using its third string of drill pipe, but has required replacement only of two high-speed chains, a rotary chain, and a bearing under the rotary drive sprocket. The original brake rims, clutches, torque converter, and motors continue to give good service.

Fred Hammond is the tool pusher. The wells drilled are 3,800 to 4,500 ft. deep, but one was drilled to 5,760 ft. The rig frequently is moved 60 to 90 miles between locations. Larry Hay and Jerry Jones are co-owners of the company, which operates principally in Central and Northwest Kansas.

Johnston Pump Opens Sales Office in Houston

Johnston Pump Co., Pasadena, Calif., a division of The Youngstown Sheet & Tube Co., has opened a southwestern sales office in Houston, according to A. H. Miller, executive vice president and general manager.

Dan Meyer, district sales manager, will be in charge, assisted by Ski Marzak, district representative.

Johnston Pump Co. is a pioneer designer and manufacturer of deep-well turbine pumps.

Hodges Heads Dresser's New Plastics Department

S. B. HODGES

Announcement has been made of the formation of a plastics products department at Dresser Manufacturing Division, Dresser Industries, Inc., Bradford, Pa. S. B. Hodges, marketing manager, will coordinate activities of the new department for Dresser. The new department will develop and market plastic products for joining, repairing and maintenance of pipe.

Coincident with establishment of the new department was the election of H. Z. Hight to president of Bonded Products, Inc., Orange, N. J., manufacturer for Dresser of Epi-Seal plastic products.

Hight, regular products sales manager of Dresser since 1945, has worked with piping problems for the past 20 years. For the past 3 years he has coordinated all phases of Dresser's planning for plastics research and will continue to work with Dresser on a number of projects being pursued jointly by Dresser and Bonded Products. Hight will also continue as a consultant on the marketing of plactics and other Dresser products.

Plastic Applicators Names Rice to Lafayette Area

Ralph J. Rice has been appointed sales representative for Plastic Applicators, working out of its Lafayette, La., office. He will act as field sales and service representative for Plastic Applicators' tubular goods inspection services and baked-on plastic coatings.

Rice has spent 2 years in research on corrosion-preventive coatings. He has also performed technical sales and service on corrosion inhibitors and other organic chemicals with Tretolite Co.

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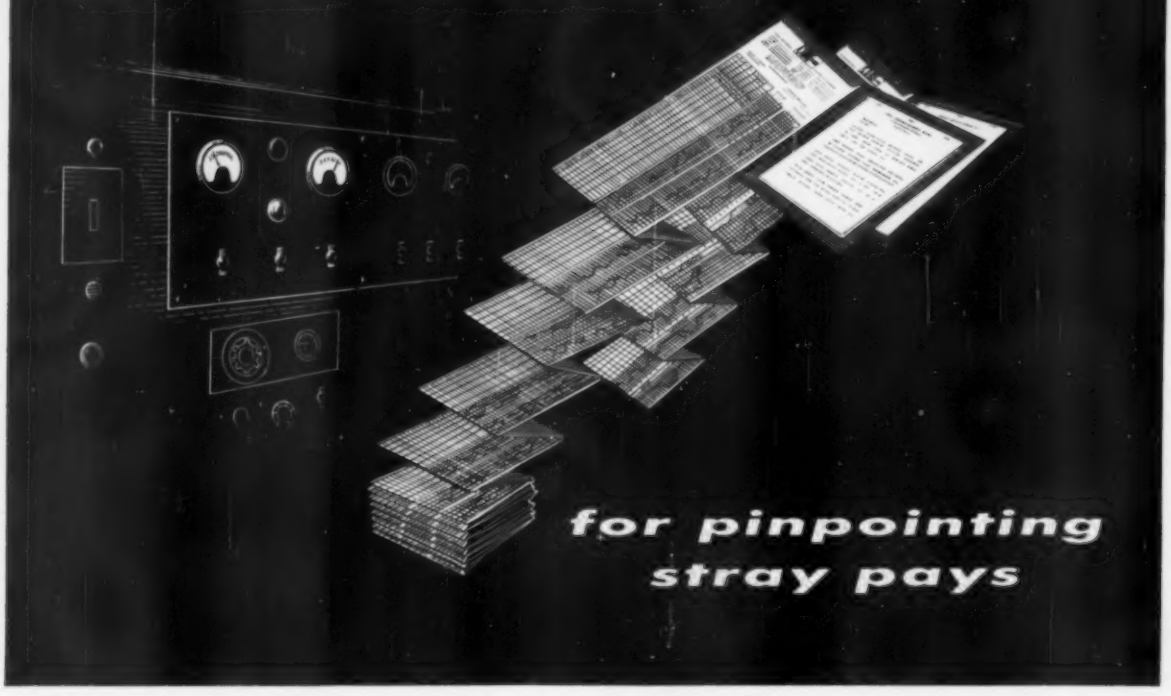

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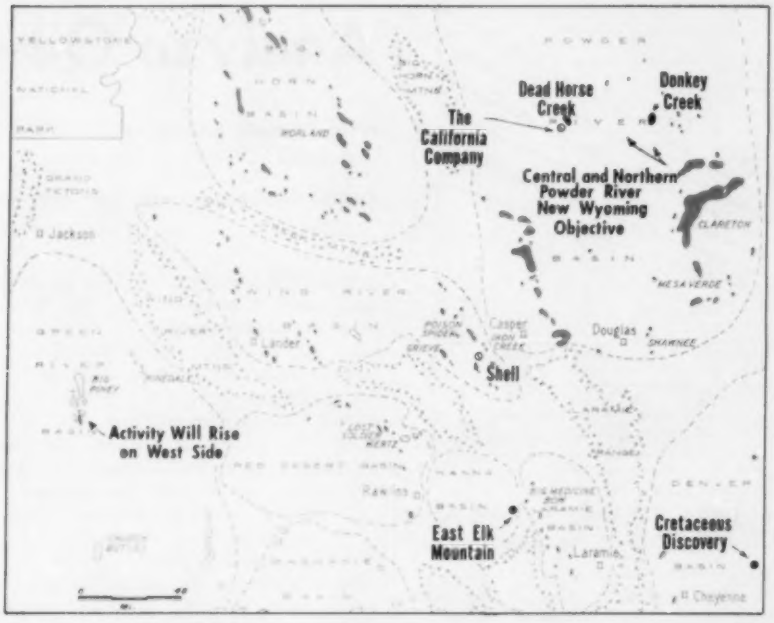


WYOMING'S MANY BASINS are geared for a new surge of wildcat activity as a record 80 rotaries probe the state's depths.

Wyoming Still Abounds With Wildcat Prospects

By John C. McCaslin
District Editor

ALTHOUGH Wyoming is the biggest producing state in the Rocky Mountains is still abounds with real wildcat country. Every basin in the state (Wyoming has more basins than any other comparable area) has production . . . some of the basins are black with oil fields, others just barely powdered with them. Despite this well-distributed splattering of oil and gas fields, a look at the Wyoming map points up many rank and inviting wildcat prospects, the most tasty of which appear to be the Powder River, Hanna, Green River, and Wind River basins.

Exploratory success in Wyoming has waxed and waned over the years. Each new spurt of wildcat discoveries shifts interest from one corner of the state to the other. As fall operations go on stream, more than 80 rotaries are churning in this "Texas of the Rockies." Both wildcat and development-well completions are running ahead of last year, despite the national trend downward. Here are some of the reasons for this upsurge:

Power River . . . This northeastern Wyoming basin is the second largest in the U.S., and recently has become one of the most closely watched.

For many years prolific production has been found on the southwest and east sides of the basin, but little was done in the northeast, north, and the center, as is the case in most Wyoming basins. This year and last a spirited stratigraphic search has paid off handsomely in the basinward Cretaceous and Pennsylvanian sands. Minnelusa-Pennsylvanian discoveries at Donkey Creek plus Parkman-Mesaverde (Cretaceous) discoveries in the very middle of the basin at Dead Horse Creek have given Wyoming operators a much-needed shove into the great potential of the central part of the basin.

The Donkey Creek deep discovery will set off a play into Pennsylvanian sands below the usual target in this area, while fast development of the Parkman is indicated in the central part of the basin. This sand has never been fully evaluated and was pushed aside as wildcatters looked for other production.

Hanna . . . This southern Wyoming basin provided the biggest wildcat news of the year. Pan American Petroleum Corp. found prolific Sundance-Jurassic production at the East Elk Mountain wildcat in Carbon County, 6 miles southwest of Medicine Bow field. The well flowed 175 bbl. of oil per hour on drill-stem tests.

Pay zone of the Hanna basin discovery is not new, but the prolific potential of the well is. There is Sundance production in other fields in this basin and its connecting neighbor, the Laramie basin. The wildcat's rank position south of Medicine Bow plus its big potential prove the point that Wyoming has many exploratory surprises yet to come.

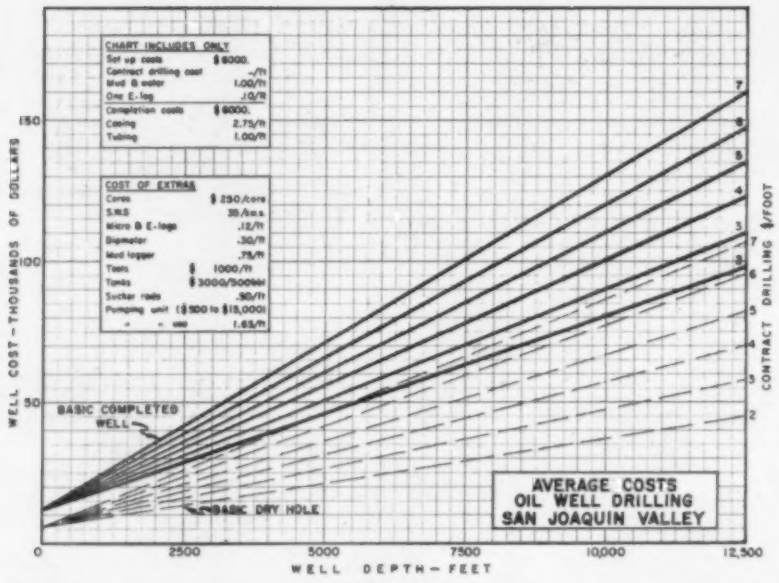
Green River basin . . . This vast southwestern Wyoming basin probably holds some of exploration's biggest surprises, but previous predictions of a big drilling spree here have fallen by the wayside. Recent discovery of oil at Big Piney by Gulf Oil Corp., plus reports of impending unit approvals in the Green River country, still lead us to predict an increasing drilling tempo in the western part of the basin. Gulf's Mesaverde discovery found oil, but was completed as a gas well.

Wind River basin . . . Shell Oil Co. will try to put this famous Wyoming oil basin back in the running after 2 years of comparative quiet. The Shell Natrona County wildcat, 4 miles southwest of Iron Creek and 13 miles southeast of West Poison Spider, is nearing 10,000 ft. on its way to a 12,600-ft. Morrison mark. Wyoming's big wildcat story of 1954 and 1955, the Grieve Unit, lies 14 miles west of the Shell try.

In short . . . Wyoming exploration will show itself in the northern and central Powder River basin, on the west side of the Green River basin, and in the southern basins. More Cretaceous and Pennsylvanian discoveries in the Powder River, a real oil play in the Green River, additional Sundance strikes in the Hanna basin, and another flurry of success in the southeastern Wind River basin . . . This is what Wyoming explorers are hoping for.

These Charts Analyze Oil-

- **How much will it cost to drill a well?**
- **How much oil will pay for a well?**



CHARTS like this can be constructed easily for any district. With them it is possible to estimate accurately the cost of either a producer or a dry hole. Fig. 1.

By L. F. Ivanhoe

A BRIEF economic evaluation is commonly required during the study of any prospect or submittal. A rapid qualitative, rather than a quantitative evaluation, is usually sufficient for this preliminary analysis and a costly detailed appraisal is generally neither necessary nor desired.

Answers are usually desired to the following questions:

1. How much will the well cost?
   a. Dry.
   b. Completed.
2. How much oil will be required to pay off the investment?
3. How long will it take to recover the investment?
4. What is the economic limit of the well?
5. How much oil and how long will the well produce at probable decline rates?

These questions can be answered readily by the use of simple graphs, such as those which accompany this article. Two of these: "Average Costs of Oil Well Drilling" (Fig. 1) and "Basic Operating Costs of Company Leases" (Fig. 3) will vary with each district. Each operator can readily prepare similar graphs for his peculiar problems. Study shows that most drilling expenses can be separated into routine basic charges that are fairly constant for all wells and other charges that vary with the depth of the well, or can be averaged in some way. However, only a generalization is possible for some items (pumps, etc.) which may be most erratic in cost in the same area.

Operating costs commonly vary greatly between leases. The usual problem of a preliminary evaluation is merely to determine the approximate economic limit of a property and generalized charts suffice for this purpose. Cost charts can be periodically revised as additional experience is gained in an area. It is most convenient if the charts are stripped to essentials so any interested person can use them easily.

The other two charts (Figs. 2 and 4) apply to all cases and do not vary with each district. The "Well Payout" chart is used to determine the number of barrels of oil required to return an investment, which may be estimated with the "Cost of Drilling" chart or by any other means.

The "Universal Decline and Production" chart (Fig. 4) summarizes data from a series of calculated decline curves. It is useful to determine the relationship of ultimate production, daily production, and time of production for various decline rates. Many routine problems concerning length of time to pay out well costs, recoveries, reserves, etc., can be read directly from the graph. The effect of various decline rates on total ultimate and daily production are visually apparent. The size of the chart covers most routine evaluations, but an extended chart is required in areas of high production.

Average well costs, San Joaquin Valley . . . This chart (Fig. 1) permits rapid preliminary estimates of well-drilling costs in the San Joaquin Valley of California. The various graph lines for dry holes include setup charges ($6,000), mud and water supplied by the company ($1 per foot), and one electric log (10 cents per foot) in addition to the drilling contractor's rate per foot drilled. The completed well costs include the additional routine charges for completing a well ($6,000), casing, and tubing, in addition to the basic costs of the dry hole. Average setup and completion costs are itemized in the accompanying lists.

Few wells are drilled at the minimum rates indicated here and extra charges must be added to the basic costs depending on the individual well-drilling program. The approximate costs to the company for the more common extras are listed on the chart for convenience. These extras include routine rig-time and company charges.

EXAMPLE—COST OF WELL
(Dry hole or producer, 5,600 ft.)

Basic cost of dry hole to 5,600 ft. at $3.50 per ft. contract		$31,500
Extras:		
Mud logger, 2,000 ft. at .75	$1,500	
Cores, 3 at $250	750	
Side wall samples, 20 at $35	700	
Dipmeter, 1,000 ft. at .30	300	
Extra logs, 4,000 ft. at .12	480	
Tests, 2 at $1,000	2,000	
Total for extras		5,730
Total estimated cost of dry hole		$37,230
To complete as a pumper at 5,600 ft.:		
Basic cost of completed well at $3.50 per ft. contract		$58,000
Total cost of extras for dry hole		5,730
Pumping unit at $1.65 per ft.		9,240
Sucker rods at .50 per ft.		2,800
Tank, 1 at 500 bbl.		3,000
Total cost of completed well		$78,770

Well-payout chart . . . Fig. 2 permits rapid determination of the number of barrels of oil required to pay out or regain a given investment. The operating profit per barrel is calculated by merely subtracting the royalty, mineral taxes, and operating costs from the price of oil per barrel. Various operating profits are indicated by the diagonal lines and additional values can be obtained by simple extrapolation. The chart does not include any discount for interest of invested capital.

Can Help You Prospect Costs

- **How long will it take for a well to pay off?**
- **What is the economic limit of the well?**

EXAMPLE

Total investment		$78,500
Price of oil (bbl.)	$3.25	
Taxes, bbl.	.15	
Operating costs, bbl.	.65	
Royalty (16⅔ per cent), bbl.	.54	
Operating profit, bbl.		$ 1.91
Payout (from chart), bbl.		41,000

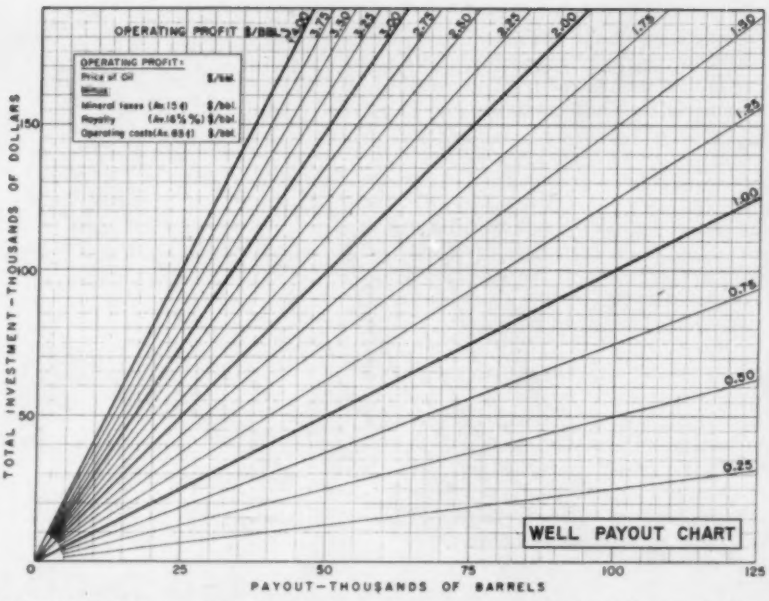
Basic operating costs . . . Fig. 3 is useful to estimate the minimum production required to operate a company lease profitably in the San Joaquin Valley oil district of California. Basic costs for operating leases with company personnel and equipment are included. Actual operating costs for different leases can vary greatly, so this chart should be used only as a gross approximation.

Labor costs include the hourly wage plus fringe benefits and other company costs for a full 30 days during a month. Pickup operating expense is about $100 per month for average cases. The chart includes a daily round trip driving time of 1 hour. Basic supplies and pump fuel (electricity, etc.), are each estimated at $20 per well per month. One pump workover per year is included for each pumping well ($240 per workover) at $20 per well per month. Labor is not assigned as full time to the lease unless there are five or more wells. Flowing wells save the costs of pump fuel, pump pulling, and some supplies. Many leases will have additional expenses that are not included in Fig. 3.

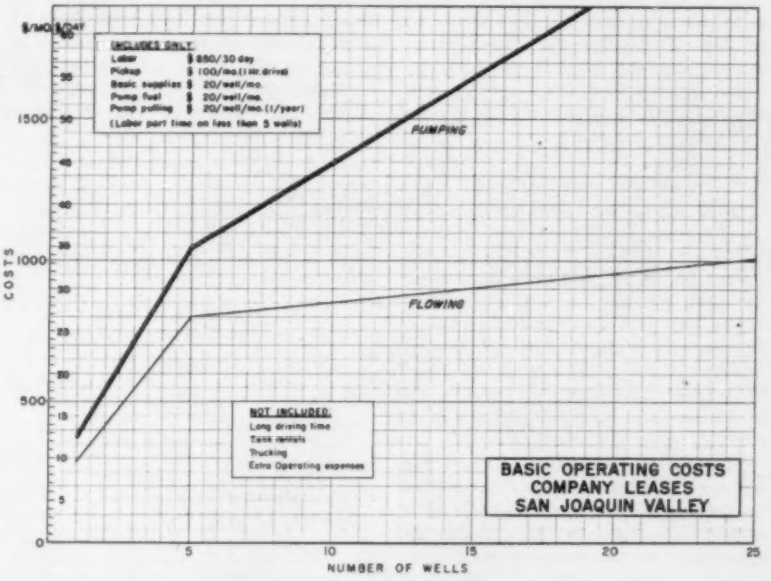
TABLE 1—BASIC WELL COSTS
(San Joaquin Valley—dry holes)

Drilling bond	$ 25
Survey location	100
Build location	250
Conductor pipe	220
Casing head	550
Surface casing (250 ft.)	1,350
Truck surface casing	100
Casing accessories and tools	400
Welder	50
Cementing surface casing	575
Blowout preventer	400
Electric log—setup charge (one only)	150
Cement for plug	400
Day work on rig (1 day)	700
Cleanup location	400
Miscellaneous	200
Supervision	130
Total basic costs—dry hole	$6,000
Costs per foot:	
Drilling (at contract footage rate) variable	$
Electric log (one)	.10
Mud and water	1.00

Extras, not included: Cores at $250 per core; Side-wall samples at $35 each; continuous dipmeter at $0.30 per ft.; micro and electric logs at $0.12 per ft.; mudlogger at $0.75 per ft.; tests at $1,000 each; tanks at $3,000 (500 bbl.).



PAYOUT TIME is an all-important factor in determining if a well should be drilled. Here is a chart that will give the payout period at a glance. Fig. 2.



THIS TYPE OF CHART helps answer the question, "What does it cost to operate a lease?" Similar charts can be prepared for other districts. Fig. 3.

Example

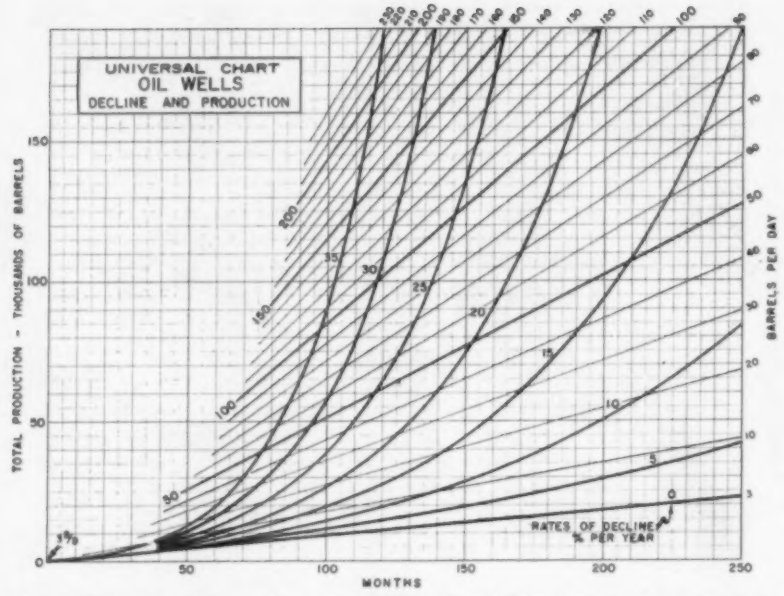
What is minimum daily production required to operate a company lease if:

Oil, per bbl.	$3.25
Royalty, 16⅔ per cent (per bbl.)	.54
Mineral tax, per bbl.	.15
Left for operating and profit, per bbl.	$2.56

From chart:

No. of wells	Cost per day	Minimum bbl. at $2.56 to operate
1	$13	5.1
2	18	7
5	35	13.7

Universal chart . . . Fig. 4 shows the total ultimate production that will be produced from an oil well in any given period of time and at any decline rate



THE UNIVERSAL CHART shows the total ultimate production from a well at any given decline rate. Economic producing limit is taken as 3 bbl. per day. Fig. 4.

to an ultimate economic limit of 3 bbl. per day. The daily rates of production at any time and decline rate can also b read directly from the graph. A daily rate of 3 bbl. was selected as a practical limit to the chart.

The intersections of the diagonal "barrels per day" lines with the "rates of decline" curves give points which can be read directly as total production and months on the chart ordinates.

Changes in the rate of daily production (bbl. per day) at any decline rate during any period of time can be read directly on the chart. Any problem involving these four factors can be solved by merely subtracting or adding the values for total production and months obtained from the chart.

Changes in the rate of decline during the life of a well must be handled by breaking down the variable rate of decline into several straight-line decline rates for given periods of time.

THE AUTHOR

L. F. Ivanhoe is a consulting geologist and geophysicist, Bakersfield, Calif., specializing in petroleum exploration. He is a graduate of the South Dakota School of Mines and received his master's degree in geology from Stanford University. Ivanhoe has had broad experience in oil exploration, both in the United States, Canada, and South America. He is a specialist in the integration of geology and geophysics in complex structural and thrust-faulted areas. He is a member of several professional societies and has published technical papers on the interpretation of geophysics.

Total production is then determined for each period and the results added together to obtain the total production.

Studies by the Conservation Committee of California Oil Producers show that the average annual decline rate for all wells in the state is 15 per cent. This includes an average annual decline rate of 35 per cent during the first 6 months, 15 per cent for all wells over 1 year old, and 10 per cent for all wells over 4 years old.

UNIVERSAL CHART
(Oil wells, decline and production)

Example 1

Given: Initial daily production of 60 bbl.
Field decline of 15 per cent per year.
Answers from chart:

Total ultimate production (to 3 bbl. per day), bbl.	129,000
Months required to produce to ultimate production	223
Months to pay out 41,000 bbl.	28

= months to produce 129,000 ultimate bbl. = (223) minus months to produce (129,000 – 41,000) ultimate bbl. = (195)

Daily rate of production at time of payout, bbl. per day	42
Net remaining oil after payout to 3 bbl. per day limit, bbl.	88,000
Net remaining oil after payout to 10 bbl. per day limit (88,000 – 16,000) bbl.	72,000
Months to produce after payout to 10 bbl. per day limit (195 – 90)	105

Example 2

Given: Minimum production to operate at profit, 10 bbl. per day. Production required to pay out completed well.
Answers from chart:

Minimum initial daily production required to return investment and months required to do so:

At 10 per cent per year decline
= intersection of 10 bbl. per day and
10 per cent curve = 24,000 bbl. (138 mo.)
+ 41,000 bbl.

= point on 10 per cent decline curve = 65,000 bbl. (224 mo.)

= production rate to pay out well at 10 per cent annual decline (22 bbl. per day (86 mo.).

At 20 per cent per year decline
= intersection of 10 bbl. per day and
20 per cent curve = 12,000 bbl. (68 mo.)
+ 41,000 bbl.

= point on 20 per cent decline curve = 53,000 bbl. (133 mo.)

= production rate to pay out well at 20 per cent annual decline—35 bbl. per day (65 mo.).

Example 3

New well with initial production of 63 bbl. per day—variable decline rates.

Answers from chart:

Total ultimate production at constant 15 per cent average decline—137,000 bbl.

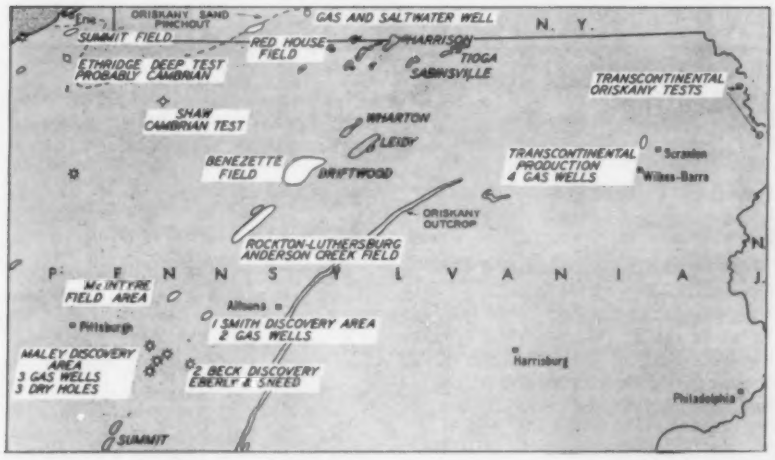
Avg. decline rate:	Mo.	I.P. B/D	Ultimate total
35 per cent	6	63	10,000
25 per cent	6	50	8,000
20 per cent	12	43	14,000
15 per cent	24	35	22,000
10 per cent	240	25 to 3	77,000
	288		131,000

TABLE 2—BASIC WELL COSTS
(San Joaquin Valley—Completed Pumping Wells)

Drilling bond	$ 25
Survey location	100
Build location	250
Conductor pipe	220
Casing head	550
Surface casing (250 ft.)	1,350
Truck surface casing	100
Casing accessories and tools	400
Welder	50
Cementing surface casing	575
Blowout preventer	400
Electric logs—(setup charge) (one only)	150
Cement for production casing	500
Accessories for production casing and tools	700
Welder	100
Truck casing and tubing	300
Perforating (25 ft.)	750
Water shutoff tests	375
Complete tubing head and fitting	1,000
Day work on rig (3 days)	2,000
Bit (clean out) and casing scraper	300
Clean up location	400
Vacuum truck (clean up)	200
Pump with pump shoe	450
Supervision	130
Miscellaneous	625
Total basic costs—completed pumping well	$12,000

Costs per foot:	
Drilling (at contract footage rate) variable	$ ...
Electric log (one)	.10
Mud and water	1.00
7-in. casing (f.o.b. Bakersfield)	2.75
2½-in. tubing	1.00

Extras, not included: Cores at $250 per core; side-wall samples at $35 each; continuous dipmeter at 30 cents per foot; micro and electric logs at 12 cents per foot; mudlogger at 75 cents per foot; tests at $1,000 each; tanks at $3,000 (500 bbl.); sucker rods, 50 cents per foot; pumping unit at $1,500 to $15,000 (use $1.65 per foot).



HOT SPOTS in Pennsylvania and New York's northern Appalachian basin gas-development drilling activity are shown in this map.

Northern Appalachian Basin Gets Wide Gas Play

by Carl H. Roberts

FROM southwestern Pennsylvania to southeastern New York, the northern part of the Appalachian basin is the scene of a widespread development and exploratory drilling program. New ideas, new techniques, and a better than average discovery rate have given stability to the gas industry which in recent years has been a boom or bust business in this region. Drilling activity that was once concentrated in one or two fields is now spread over many developing, producing areas.

Increased wildcatting along producing trends and in areas that have never produced indicates the optimistic outlook of operators in the region.

New pool . . . The most active area at present is the Rockton-Luthersburg-Anderson Creek Onondaga chert-Oriskany sandstone field in western Clearfield County, Pennsylvania. This stratigraphic type of trap field which extends 12 miles northeast-southwest recently got new life with the completion of the 1 Bloom well of New York State Natural Gas as a new pool discovery. This well was the largest in the area with an open flow of 60 M.M.c.f.d. This new pool is northwest of the present productive area and cut off from it by a reverse fault. Three additional development wells have been completed in this pool with flows ranging from 15 to 20 M.M.c.f.d.

Exploratory activity is presently under way in an attempt to extend production northeast and southwest along this fault trend, as well as northeast of the established producing trend. Overlooked to date, is extension testing of the southwestern limits of the field near Luthersburg. This end of the field is not clearly defined and will probably come in for more drilling in the future.

McIntyre area . . . Development drilling in the McIntyre area of southwest Indiana County is virtually completed. Since the completion of the 1 Stewart discovery well in this area (OGJ, Dec. 17, 1956) a total of 27 wells have been drilled. Open flows ranged from 100 to 4,000 M.c.f.d. after fracturing the Onondaga-Oriskany section. Considerable salt water is produced with the gas and reportedly production histories of the wells are discouraging.

Considerable gas production was encountered in the relatively shallow Bradford sand in this area and many wells were completed as producers from this sand.

Activity near two other late 1956 discoveries is slow. In southern Westmoreland County development drilling to the 1 Maley (OGJ, Dec. 17, 1956) discovery has been hazardous due to the complex faulting in the area. However, the most recent completion by Peoples Natural Gas on the 1 Keck had an open flow of 11,600 M.c.f.d. from the Onondaga chert section.

The confirmation well to the 1 I. R. Smith (OGJ, Dec. 17, 1956) of Columbian Carbon in Brush Valley Township, Indiana County, was completed with a final open flow of 2,740 M.c.f.d. from the Onondaga chert and a wellhead pressure of 4,400 psi. This well, 1 Stewart of T. W. Phillips, is located ½ mile north of the discovery well.

Latest discovery . . . The latest wildcat discovery in southwestern Pennsylvania was the 2 Beck well drilled by Eberly & Snee on the Laurel Hill anticline along the Westmoreland-Somerset counties border. This well was completed in the Onondaga chert at a depth of 7,540 ft. with an open flow of 7,100 M.c.f.d. A confirmation well to this discovery is presently being drilled by Felmont Oil Corp.

In northwestern Pennsylvania more wildcat drilling is present than in many years. In this shallow part of the Appalachian basin, deeper formations are the objective of many tests although the Oriskany is still the main target.

In southern Warren County, the 1 Shaw of Beiry & Johnson was recently drilled to the Gatesburg formation of Upper Cambrian age. Salt water was encountered in this formation at 9,410 ft. Now the operators are attempting to complete the well in the Onondaga chert section between 4,452 and 4,528 ft.

Deep test . . . Another test scheduded to be drilled to 9,500 ft. is the 1 Ethridge of Allegany Industrial Corp. This test is located in southern Erie County.

The recent discovery of two Oriskany sandstone gas fields along a northwest pinchout of this formation has stimulated further exploration along the trend of this feature which extends into New York State.

One of the above-mentioned fields —Summit field, has been developed south of the city of Erie in Erie County. The gas accumulation in this field is controlled by a small east-west trending fold in conjunction with the sand pinchout. The wells averaged approximately 2,400 ft. in depth and open flows ranged from 500 to 20,000 M.c.f.d.

The other field along this Oriskany pinchout is located 70 miles east of the Summit pool in Cattaraugus County, New York.

Red House field . . . The discovery well in Red House field was drilled by

Author is consulting geologist, Coudersport, Pa.

Felmont Oil Corp. This company has drilled six of the seven producing wells in this field.

The gas accumulation in this field is controlled by a structural nose along the sand pinchout line. Producing wells range in depth from 3,600 to 4,300 ft. The open flows were from 2,000 to 8,500 M.c.f.d. A considerable amount of distillate is produced with the gas.

Exploratory activity in this area is aimed at extending production southwest towards the Pennsylvania border and towards a recently completed gas and salt water well 25 miles northeast in Allegany County, New York.

Drilling play . . . Northeastern Pennsylvania and southeastern New York, an area which until recently has been virtually ignored, is presently having a leasing and drilling play that was initiated by Tranescontinental Producing Co. This company is presently drilling Oriskany tests in Pike and Wayne counties, Pennsylvania.

Transcontinental's activity has already turned up a shallow field in western Lackawanna County and it was recently announced that deliveries of gas from this field were to be made to local distributing companies. **End.**

S.E.G. Plans Meeting

"International Geophysics, both Practical Applications and Pure Science," will be the dominant theme of the twenty-seventh Annual Meeting of the Society of Exploration Geophysicists (S.E.G.) in Dallas, Tex., November 11-14, 1957.

Middle East political uncertainties plus recent important oil discoveries in French North Africa and Turkey have made oil developments in these areas of vital importance to the whole western anti-communist world. These pappers on practical geophysical problems in oil exploration in French North Africa will be given by French geophysicists, and one on Turkey will be presented by S. Diker, of Ankara, Turkey. In the western hemisphere there will be a paper on Guatemala and one on the Caribbean area.

In the search for commercial deposits of oil and other minerals in foreign countries, geophysicists find that local national and international policies may pose problems just as tough as those mother nature presents to those who would uncover her hidden wealth. So—S.E.G. will hear practical papers with such titles as "Geophysics and Geopolitics;" "Inter-dependence in World Wide Oil Exploration;" "Orientation of Personnel in Foreign Operavtions;" and "Logistics in Foreign Operations."

EXPLORATION HIGHLIGHTS

APPALACHIAN

OHIO

Layland Extension Is Gas Success

An extension, ½ mile north of production in Layland pool, gaged 1,500,000 cu. ft. natural and 4,700,000 cu. ft. daily after fracture. The gasser, Contract Drilling Co. 1 Marion Root, Section 8, Monroe Township, Coshocton County, logged the Clinton at 3,519-45 ft.

Gas Well Tapped South of Gratiot

South of the Gratiot pool in Hopewell Township, Muskingum County, Devonian Oil Co. 1 J. P. Brandon, Section 4, found the Clinton at 3,273-97 ft. with 1,980,000 cu. ft. natural.

Newburg Gas Found At Wayne Extension

In Franklin Township, Wayne County, Ditch & Hanna 1 Emma Siegle, Section 2, ½ mile north of the present producing area, discovered gas in the Newburg sand topped at 3,045 ft. Drilling is continuing at 3,064 ft. with a gage of 625,000 cu. ft. Sixteen rigs are now running in the pool.

PENNSYLVANIA

Westmoreland Wildcat Is Chert Gas Strike

In Mount Pleasant Township, Westmoreland County, Southwest Pennsylvania, Peoples Natural Gas Co. No. 4123 Earl Shultz, rank wildcat, was successful with gas gaging 6,154,000 cu. ft. after fracture in the chert. The Tully was 6,590 ft., Onondaga 7,207 ft., chert 7,226 ft., Oriskany sand 7,377 ft., total depth 7,435 ft.

CALIFORNIA

Pleito Creek Extension Nearing Completion

Shell Oil Co. was reportedly nearing an important extension of the Pleito Creek field in southern Kern County with a wildcat 1 mile northeast of production. Shell was moving out the rig on the 13,804-ft. 48-25 KCL in SE SW 25-11n-21w after gun perforating seven intervals between 11,626 and 11,674 ft. This area of activity is a little more than 1 mile west of the Telegraph Canyon part of Wheeler Ridge field.

Superior Has Good Shows in Paloma Test

The Superior Oil Co. was reaming to run casing in a 10,415-ft. wildcat in the Paloma field of Kern County after a formation test at 10,054 ft. indicated a 600-bbl. daily well on completion. The wildcat is in NE SE 10-32s-26e. Nearest Paloma production is ¾ mile north. The Superior well is only 1¾ miles southeast of Ohio Oil Co.'s former depth record holding 21,482 ft. 72-4 KCL A.

Shell Finds Gas Field at Vallecitos

Shell Oil Co. hit a new gas field with a wildcat 2¼ miles north of Vallecitos field in San Benito County. The discovery well, 31-35 Breckenridge, was completed flowing 5,000 M.c.f. daily of natural gas through a 32/64-in. choke. Perforations are at six intervals between 2,585 ft. and 2,710 ft. Total depth is 5,118 ft. Plugged-back depth is 2,735 ft.

McCulloch Scores in Fresno, Kern Counties

McCulloch Oil Exploration Co. of California, Inc., chalked up two important completions—one in Fresno County and the other in Kern County.

The Fresno completion resulted in a new sand discovery on the east flank of the Lanare area of Helm field. The well, 1 McCulloch-Summit Lake, was brought in flowing 139 bbl. daily of 33°-35°-gravity crude from an interval at 6,846-51 ft.

The other McCulloch success was 2 McCulloch, an extension test about ¼ mile northeast of production in the Calders Corner area in Kern County. The operator swabbed to 6,000 ft. and completed the 9,720-ft. well flowing by heads at a 60-bbl. daily rate through an 8/64-in. choke. The perforations are between 8,699-8,719 ft.

Exploration This Week

Appalachian	176
California	176
Canada	177
Illinois Basin	177
Oklahoma	178
Rocky Mountains	178
Texas	179
Wildcats	180

CANADA

ALBERTA

Cardium Oil Found At North Keystone

Canadian Oil Companies, Limited and Supertest Petroleum Corporation, Ltd., announced the discovery of oil in the Cardium sand formation at their joint exploratory hole in the North Keystone area of west-central Alberta. The new strike, White Rose-Supertest 8-14-49-5 Alsike, on LSD 8, 14-49-5w5, gave a recovery of 600 ft. of clean oil during drill-stem test. The same test also flowed gas to surface at rate too small to measure and an additional 200 ft. of gassy oil-cut mud was also present in the pipe upon completion of the evaluation.

This strike is situated 2½ miles northwest of the main development sector of Keystone oil field, which lies about 10 miles east of Pembina, and is about 2½ miles southwest of the Cities Service-Alsike extension successes. It is being drilled by Canadian Oil and Supertest, on farmout rights acquired from Imperial Oil, Ltd., and Canadian Superior Oil of California, Ltd.

The assured Cardium success is now being carried on down to the Mississippian structure at a depth of approximately 6,050 ft.

Basal Quartz Oil Tapped At East Acheson

Union Oil Co. of California has struck what appears to be commercial oil success at a well in the general Edmonton district of central Alberta and after fully penetrating the oil structure has commenced drilling operations in order to evaluate lower horizons. The new strike was in the basal quartz horizon at the Union 2-30-52-25 Acheson East test on LSD 2, 30-52-25w4, which lies 2 miles east of oil production in the Acheson Devonian oil field and 3½ miles west of Edmonton's city limits.

Drill-stem test to indicate success at this wholly-owned venture covered a 30-ft. interval below 4,015 ft. Gas pockets in the drill-pipe caused oil to be forced to the surface after the completion of the evaluation. Final pipe recovery was 1,860 ft. of greenish light gravity oil. A further test, of the next 25 ft. of zone gave up 180 ft. of gas and oil-cut mud and 270 ft. of salt water—indicating that the full oil pay had been penetrated.

Crew of the drilling rig operating on the hole is currently drilling ahead with total depth anticipated around 5,400 ft., in the D3 zone of Devonian.

BRITISH COLUMBIA

Oil Found at Two Blueberry River Wells

Probably the most important exploration news to come out of western Canada last week was an announcement by Fargo Oils, Ltd., of Calgary, that Mississippian oil had been struck at a pair of wells drilled on behalf of itself and others in the Blueberry River area of northeastern British Columbia. The company, working in conjunction with White-Lloyd and Associates, of Dallas, Tex., and Gulf States Oil Co., reported that through production test operations at a previously completed gas success, drilled in January of this year, that oil flowed at the rate of 569 bbl. per day through restricted choke; while the other test, 5 miles away, had recovered similar oil flows during initial evaluations of the same zone. This marks the first commercial oil from this zone in British Columbia and the development and exploration program is taking place 55 miles northwest of Fort St. John.

The initial discovery well, 11 Blueberry, on 82-L-94A-12, was originally completed as a potential gas well in the Triassic and Mississippian zones at a total depth of 7,117 ft. On tests prior to completion as a gas well, the No. 11 test flowed gas rates in excess of 10 million cubic feet daily. It was recently opened up for further back pressure tests and when the lower section of the Mississippian was perforated, flowed oil to surface. There is an estimated 40 ft. of oil pay zone present in this oil-bearing structure.

The other strike, meanwhile, 16 Blueberry, on 46-D-94A-13, was completed at total depth 7,277 ft. and evaluation tests are currently being carried out on it. This well lies to the north of the No. 11 discovery and there has been no drilling carried out between the ventures.

SASKATCHEWAN

Viking Gas Strike Scored at Cook Lake

Canso Natural Gas, Ltd. has indicated Viking sand gas success at Coleville-Smiley area venture, Canso-New Superior et al 16-35 Cook Lake. On recent drill-stem test this well flowed gas at maximum rate, 1,430,000 cu. ft. daily from the discovery horizon and further production tests will be carried out on it in the near future. The well lies on LSD 16, 35-31-22w3, 6 miles east of the Eureka, Saskatchewan Viking sand oil producing area and 3 miles west of previous gas completions in the Cook Lake area.

The operator reported that a 36-ft. interval below 2,164 ft. was evaluated and gas flowed to the surface when the valve was opened. Pipe recovery consisted of 130 ft. of gassy, slightly oil flecked mud.

ILLINOIS BASIN

ILLINOIS

East Chesterville Pool Is Big News of Year

Douglas County's Arcola area is the scene of Illinois' biggest development play this year, giving a much-needed drilling spree to the basin. The area concerned is 1 mile west of Arcola.

Since the discovery well was completed in July there have been 28 oil wells completed in this new area. The discovery well was Pierce and ZuHone 2 Susan Munson in NW NE NE 6-14n-8e. It flowed 1,250 bbl. of oil per day from Rosiclare sand. Some subsequent drilling in this field has turned up 1,344-bbl. wells. The field is now prorated. Operators active in this booming area are: Development Associates, Inc., Hill Production Co., J. L. Schaefer, Jet Oil Co., Henry P. Smith, J. Frank Hinkle, and Ensminger & Parrish.

It has been estimated that pipeline output from the field to date is more than 150,000 bbl.

Wayne County Wildcat Makes Good Oil Flow

A wildcat 4 miles southwest of Fairfield in Wayne County flowed 21 bbl. of oil per hour, natural, from the Aux Vases at 3,238-48 ft. The new discovery is Whaley Oil Co.'s 1 Galligar-Green in SE SE SW 22-2s-7e.

Drilling in Illinois Shows Slight Increase in August

Oil well drilling in Illinois showed a slight increase in August over previous months, although still well below the same period a year ago, according to the Geological Survey of the State Department of Registration and Education. A total of 292 wells were completed in August, as compared with 315 in August a year ago. Oil well completions for the first 8 months of 1957 were about 70 per cent as numerous as for the first 8 months of 1956. The 292 completions for August include 128 oil wells.

No new oil fields was discovered in August, but the August drilling report lists four extensions to pools: one each to Gards Point in Wabash County,

Ashley in Washington County, Burnt Prairie South in White County, and Trumbull in White County.

Two new pays were discovered in August, the Rosiclare limestone in Corinth pool in Williamson County, and the Bethel sandstone in Raccoon Lake pool in Marion County.

Douglas County, with 30 completions, had the most drilling during August. This was due to the development of Chesterville East pool which was discovered in July.

As in June and July, crude oil production in Illinois in August was below normal because of a refinery strike in Ohio. However, the strike was settled in the latter part of August, and production can be expected to rise. The estimated production for August is 5,059,000 bbl.

OKLAHOMA

NORTHERN

New Cherokee Trend Pool Reported in Making

A new Cherokee-Pennsylvanian oil pool on the northern border of Oklahoma is reported at Gulf Oil Corp.'s 1 Stover wildcat in SE SE 16-27n-9w, Alfalfa County. The well is 6 miles south of the Mendon - Eureka trend which has both oil and gas production from the Cherokee.

Recovery on a test of the zone at 5,234-63 ft. got 77 bbl. of new oil in 24 hours on 16/64-in. choke.

Kingfisher County's Columbia field area has production from Oswego, Layton, and Mississippian. Rapid and successful development of this fie!d appears to be heading toward extension from 18n-5w to 19n-5w.

NORTHWEST

Development Begins at Laverne Townsite Pool

Sunray-Mid Continent Oil Corp. will begin operations at 1 State-Q, C SW NE 22-26n-25w, in an effort to expand the recently opened pool at Laverne townsite, Harper County.

The well is the north offset to the 1 Holmes discovery in NW NW SE 22-26n-25w, which flowed 176 bbl. of oil per day on 24/64-in. choke. The new field will be developed on 40-acre spacing on the edge of the townsite.

ROCKY MOUNTAINS

NORTH DAKOTA

Another Burke County Discovery Indicated

The fast-moving drilling program in Burke County's Lignite field area picked up another indicated Madison strike last week at Petroleum Corp. of America and Tom Jordan 1 Jorgens in C NE NE 28-162n-91w, 3 miles southeast of Lignite field.

Recovery on drill-stem test in the Madison-Mississippian at 6,247-77 ft. was 420 ft. of oil, gas and mud emulsion, mostly oil. Pipe recovery also included 35 ft. gassy mudy, 120 ft. of gassy oil-cut mud, 70 ft. of oil and gas-cut mud and 50 ft. of gassy, slightly

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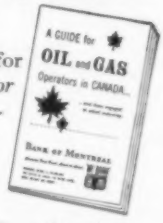

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oil and water-cut mud. Other recovery was reported on a test of the Nesson pay at 6,279-90 ft.

The new Lignite play in North Dakota currently holds the exploratory spotlight in the Williston basin. This off-Nesson anticline activity began with the discovery of Lignite field several weeks ago. The field has two producers, three wells drilling, and two wildcats in the area are showing for discovery. Northwest Oil Drilling-Central Le Duc 1 Klitzke in C SW SW 17-163n-91w, and Atlantic Refining Co. 1 Falck in C SE NW 24-163n-92w.

WYOMING

Elk Mountain Sundance Discovery Completed

Completion was reported last week at the important Carbon County Sundance discovery in the Hanna-Laramie basin area of southern Wyoming. The discovery well is Pan American Petroleum Corp. 1 UPRR-Anschutz Ranch in C NE NW 23-20n-80w, 7 miles southeast of Simpson Ridge and 6 miles southwest of South Big Medicine Bow field.

The completion flow was 534 bbl. per day and 51 bbl. water per day on 20/64-in. choke from perforations at 6,475-6,510 ft. The confirmation well, 2 UPRR-Anschutz Ranch, NW NW 23-20n-80w, is drilling below 3,364 ft.

TEXAS

EAST TEXAS

New Woodbine Producer In West Slocum Area

A new pool, or extension, has been completed in the West Slocum field area of southeastern Anderson County.

Lyons & Logan, Shreveport operators, 1 Ottom Galm, William Sims Survey, rated a daily potential of 225.6 bbl. of 41°-gravity oil. The gage was through 13/64-in. choke, from Woodbine perforations at 5,818-23 ft. Gas-oil ratio was 549:1.

The new producer is approximately 1 mile from nearest production in West Slocum field, but separated by dry holes.

New Pay at Boggy Creek

H. R. Stroube and Associates, Corsicana, had a Wilcox sand prospect for the Boggy Creek area of northeastern Anderson County at 1 W. T. Todd, 4 miles northeast of Neches townsite.

At last report the well was pumping at the rate of 40 bbl. of low-gravity oil a day, from an estimated 10 ft. of pay between 1,475-85 ft. Total depth was 3,536 ft., plugged back to 1,600 ft. Regular pay for the area is in the Woodbine.

Location is on the south flank of the field, in David Creek Survey, A-181. According to field reports, this is the most northwesterly Wilcox production in East Texas, being 60 miles northwest of similar production in Angelina County.

Deep Wildcats Slated

Nacogdoches and Henderson counties drew deep wildcat contracts last week, with drilling contracts going to Trant Drilling Co. on both tests.

One is Humble Oil & Refining Co. 1 A. T. Mast, approximately 10½ miles southeast of Douglas townsite in Nacogdoches County. It is scheduled to 11,500 ft., which is expected to penetrate the Travis Peak. Loaction is on a 629-acre lease in the T. J. Lambert Survey, A-339.

Seaboard Oil Co. has scheduled the other deep test 4½ miles southwest of Brownsboro townsite in northern Henderson County. The project will be 1 J. W. Lewis, on a 294-acre lease in the J. D. Liverman Survey, A-859. Contract depth is 10,000 ft.

GULF COAST

New Field Development Well Brought in by Associated

Gas pay has been discovered in a new deeper gas sand in Associated Oil & Gas Co.'s Trans-Tex field, Wharton County, which is located some 8 miles north of Louise, Tex.

Associated has under lease 2,370 acres in this field. The well is the 1 Hillje. Perforated at 5,031 to 5,038 ft., the sand is the deepest in Trans-Tex field. On production test the 1 Hillje flowed gas at the rate of 2,330,-000 cu. ft. daily through a 14/64-in. choke. Flowing pressures were 1,815 psi. on casing and 1,800 psi. on tubing. On 2-hour shut-in test, casing pressure rose to 2,068 psi. and tubing pressure to 2,062 psi. Associated is preparing to run an open-flow potential test on this 1 Hillje well immediately.

Besides this new pay zone, the 1 Hillje also has nine other sands uphole which give promise of future gas production. In addition Associated is now producing gas from three other sands in this field.

Production from Associated's Trans-Tex field is sold to Tennessee Gas Transmission Co. This new well will

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be the ninth from this field to be tied into the gas-gathering system.

This is the second well brought in within 2 weeks by Associated Oil & Gas Co. of Houston. On July 22 a wildcat well, Cage F 2 was brought in on the company's Cage Ranch lease in Brooks County, Texas. This well is 2 miles south of the most southerly producing well on the Cage Ranch property and this extension of 2 miles is of special significance in this field. Associated has under lease 26,757 acres on this Cage Ranch property.

Successful Wildcats

ALBERTA

Canadan Seaboard 3-26-60-2 Cold Lake, LSD 3, 26-60-2w4. Blairmore heavy oil discovery. TD 1,675 ft.

Mobil Oil 12-13 Whitecourt, LSD 13, 12-61-12w5. Indicated Beaverhill Lake oil discovery. TD 9,343 ft.

Imperial-Canadian Superior 16-29C-49-6 Pembina. Cardium sand oil discovery. TD 4,465 ft.

Banff-Hudson's Bay et al 10-5-39-8 Kessler, LSD 10, 5-39-8w5. Basal Quartz oil discovery. TD 3,400 ft.

Superior et al-Hudson's Bay 4-20 Garrington, LSD 4, 20-34-4w5. Viking wet gas discovery. TD 9,202 ft.

CALIFORNIA

San Benito County: Shell Oil Co. 31-25 Breckenridge, NE NW 35-16s-10e, 5,000 M.c.f. daily, 32/64-in. choke, perfs. 2,612-30, 2,585-2,604, 2,638-46, 2,684-88, 2690-96, 2,701-10 ft., TD 5,118 ft. (New gas field discovery 2¼ miles north of Vallecitos field).

Fresno County: McCulloch Oil Exploration Co. 1 McCulloch-Summit Lake, SE SW 13-17s-18e, 139 BOPD, 33° gravity, 8/64-in. choke, 0.4 per cent cut, perfs. 6,846-6,851 ft. TD 7,800 ft. (New sand discovery on the east flank of the Lanare area of Helm field).

COLORADO

Weld County: Shell Oil Co. 1 State, C NW SE 16-11n-58w. IPF 210 BOPD, "D" sand discovery, new field. TD 7,121 ft. "J" sand.

NEBRASKA

Banner County: Pan American Petroleum Corp. 1 Cross-B, C SW SW 28-19n-56w. IPP 150 BOPD, "J" sand discovery, new field. TD 6,240 ft. Skull Creek.

PENNSYLVANIA

Westmoreland County, Mount Pleasant Township: Peoples Natural Gas Co. 4123 Earl Shultz, 6,154,000 cu. ft. gas, after fracture. Tully 6,590 ft., Onondaga 7,207 ft., chert 7,226 ft., gas, Oriskany sand 7,377 ft. TD 7,435 ft.

WEST VIRGINIA

Randolph County, Dry Fork district: Columbian Carbon Co. 3-1264 U.S.A. Dept. of Interior G-3 elevation 2,980 ft., 5,602,000 cu. ft. gas after fracture. Onondaga 4,710 ft., chert 4,760-4,832 ft., Oriskany sand 4,953-5,185 ft., gas 5,030 ft., 5,115 ft. TD 5,439 ft.

SOUTHEAST NEW MEXICO

Eddy County: Leonard Oil Co. 2 Hagerty-Federal, 18-16s-30e. IP 240 BOPD, 24/64-in., 37-gravity, top pay 2,715 ft. TD 2,745 ft.

WEST CENTRAL TEXAS

Haskell County: Shawnee Drilling Co. 1 Hendrick estate, A. Rodriquez Sur., Subd. 22, 20 mi. E Stamford. IP 100 BOPD, 18/64-in., 41-gravity, GOR 422, TP 50 psi., pay 1,542-48 ft. TD 1,590 ft.

Shackelford County: West Central Drilling Co. 1-68-A Davis, Sec. 68, Blk. 13, T&P Sur., 12 mi. NE Abilene; new pay and E offset to 2 Davis, Morris sand discovery. IP 117 BOPD, ¼-in., 43-gravity, GOR 1800, TP 580 psi. TD 3,470 ft., elev. 1,858 ft.

Stephens County: J. E. Connally 1-A Chesley, Dorsheimer Sur. 28, 14 mi. SW Breckenridge. IP 128 BOPD, 26/64-in., TP 100 psi., 41-gravity, GOR 461, Ellenburger 4,139-43 TD 4,150 ft.

Taylor County: Ralston Oil Co. and La Gorce Oil Co. 1-A Henry Sayles, R. Willis Sur. 122, 3½ mi. SW Tye, ½ mi. N Blackwell-Moore (Capps) field. IP 192 BOPD, 20/64-in., 39-gravity, TP 30 psi., Dothan sand 1,955-67 ft. TD 2,047 ft.

NORTH TEXAS

Denton County: Fleetwood Oil Co. 1 H. E. Long, B. A. Way Sur., A-1350, 15 mi. NW Sanger. IPP 60 BOPD, 36-gravity, GOR 1000, open hole 1,614-19 ft., TD.

Wise County: Southern Union Gas Co. 1 Rogers Unit, Blk. 14, Hunt CSL Sur., A-3, 10 mi. E Alvord. IP, calculated open flow, 2,000 M.c.f. gas, plus 16 BOPD, conglomerate 6,293-6,305, 6,044-56 ft. TD. 6,826 ft. Shut-in pressure 897 psi.

Young County: J. W. Graves 1 J. J. Dodd, TE&L Sur., A-788, 1½ mi. S Jean. IPP 63 BOPD, 42-gravity, GOR 240, pay 3,022-33 ft. TD 3,080 ft.

TEXAS GULF COAST

Austin County: Mound Co. 1 Newsome et al, M. M. Kenny Sur. 156, A-352. IP 115 BOPD, ⅛-in., 41°, GOR 1,200 cu. ft. per barrel, TP 1,080 psi., perfs. 9,180-90 ft. (Wilcox). TD 10,790 ft. (New oil reservoir in Sealy area—1 mile east of field.)

Bee County: Northern Pump Co. 1 Wolters, J. Heald Sur., A-183 (7 miles northwest of Mineral). IP 48 BOPD (net), 5/32-in., 37°, GOR 400 cu. ft. per barrel, TP 500 psi., perfs. 5,986-90 ft. (Wilcox). TD 6,515 ft. (New field.)

Goliad County: Humble Oil & Refining Co. 1 Wilkinson, J. Callaghan Sur., A-81 (3½ miles northwest of Berclair). IP 4,800 M.c.f. daily, open-flow potential, GLR 150 M.c.f. per barrel, 57.5°, perfs. 4,737-94 ft. (Yegua). TD 12,000 ft. (New reservoir in Berclair area.)

A. B. Alkek 5-C Swickheimer, J. Harris Sur., A-157. IP 62,000 M.c.f. daily, open-flow potential, dry gas, shut-in tubing pressure 1,561 psi., perfs. 3,696-3,700 ft. (Frio). TD 4,100 ft. (New pay in North Alkek field.)

A. B. Alkek 6-C Swickheimer, J. Harris Sur., A-157. IP 9,700 M.c.f. daily, open-flow potential, trace of distillate, shut-in tubing pressure 1,249 psi., perfs. 3,346-48 ft. (Frio). TD 4,100 ft. (New pay in North Alkek field.)

Sun Oil Co. and George Coates 1 Eliot, James O'Neal Sur., A-224 (15 miles northeast of Goliad). IP 76,000 M.c.f. daily, open-flow potential, dry gas, shut-in tubing pressure 1,330 psi., perfs. 3,088-93 ft. (Frio). TD 4,101 ft. (New pay in Schroeder field.)

Live Oak County: Frank C. Kallina and Ralph Evans 1 Wright, M. B. Kivlin Sur., A-21 (3 miles east of Dinero). IP 83.4 BOPD, ⅛-in., 47°, GOR 537 cu. ft. per barrel, TP 550 psi., perfs. 4,299½-4,307½ ft. (Hockley). TD 4,355 ft. (New oil reservoir and outpost Mount Lucas field.)

Matagorda County: Magnolia Petroleum Co. 1 city of Palacios, Lewis Goodwin Sur., A-162 (3 miles northwest of Palacios). IP 105 BOPD, 5/16-in., 37°, GOR 891 cu. ft. per barrel, perfs. 8,104-19 ft. TD 10,762 ft. (New pay in Harrison field.)

WYOMING

Carbon County: Pan American Petroleum Corp. 1 UPRR Anschutz Ranch, C NE NW 23-20n-80w. IPF 534 BOPD, 51 BWPD, Sundance. TD 7,846 ft. Sundance discovery, new field.

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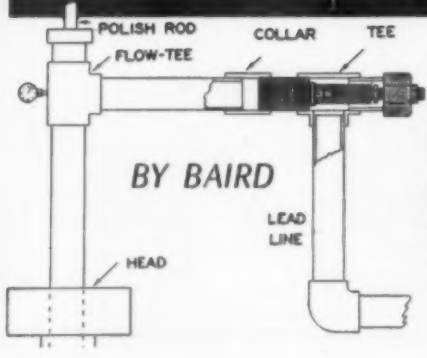

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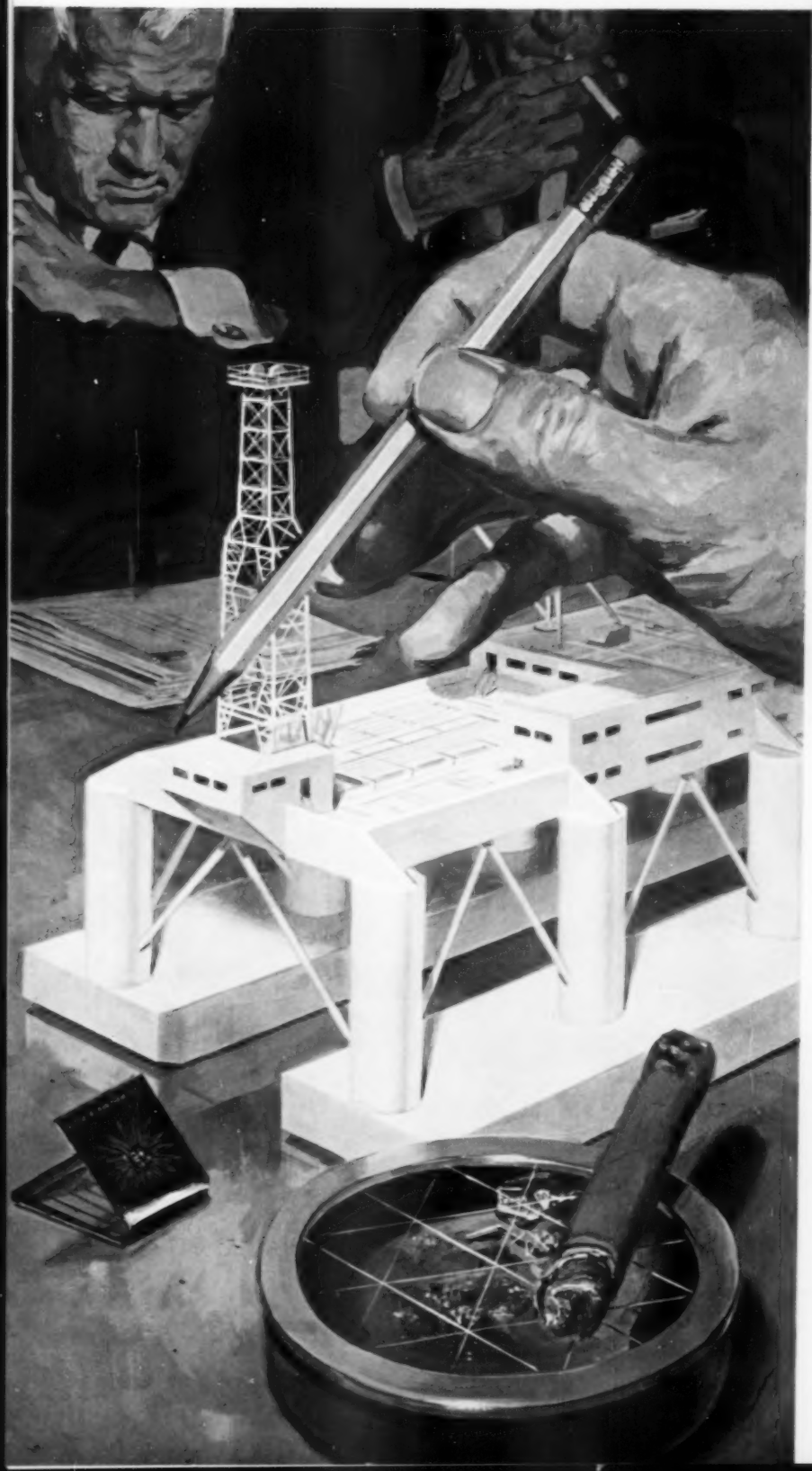

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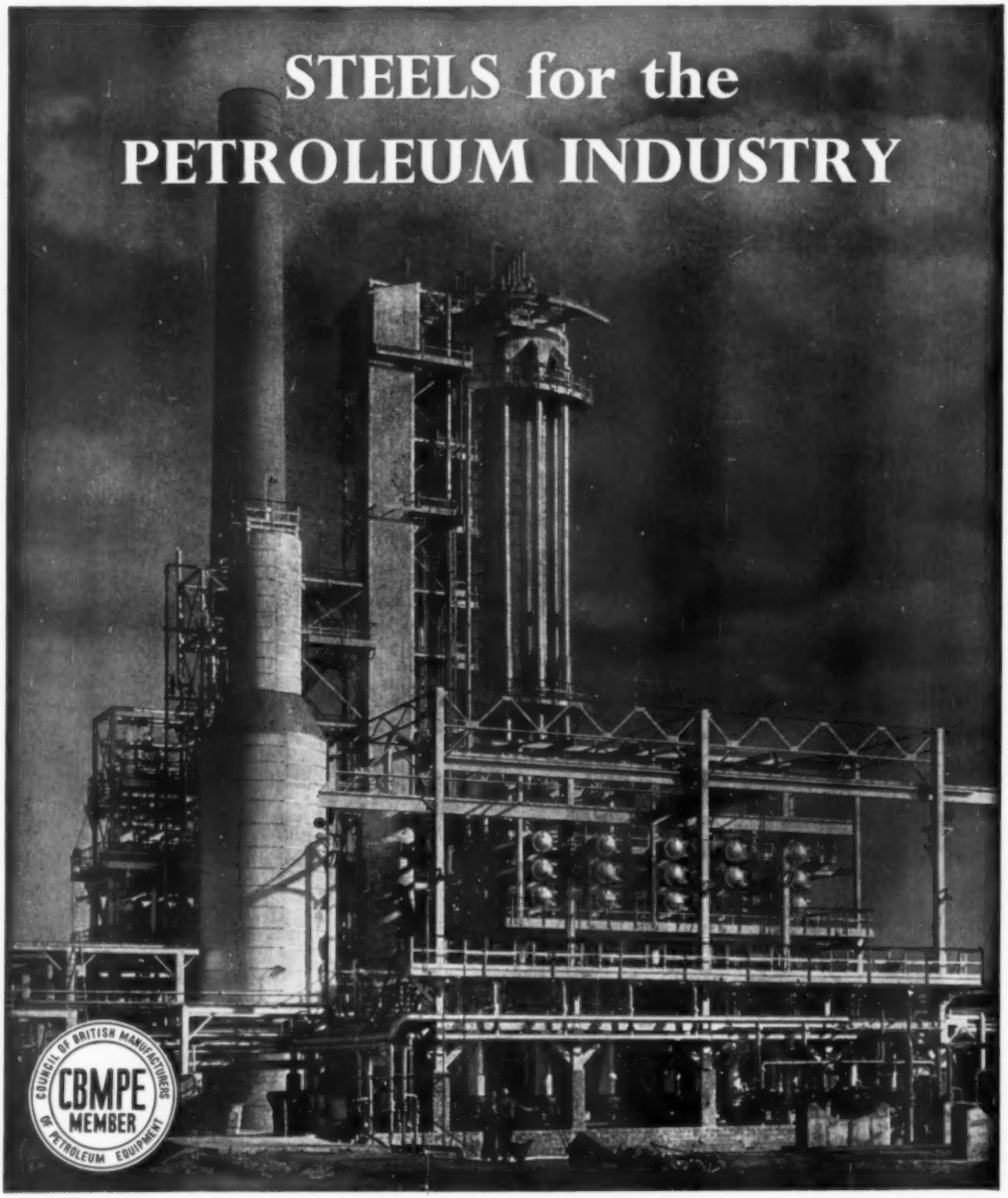

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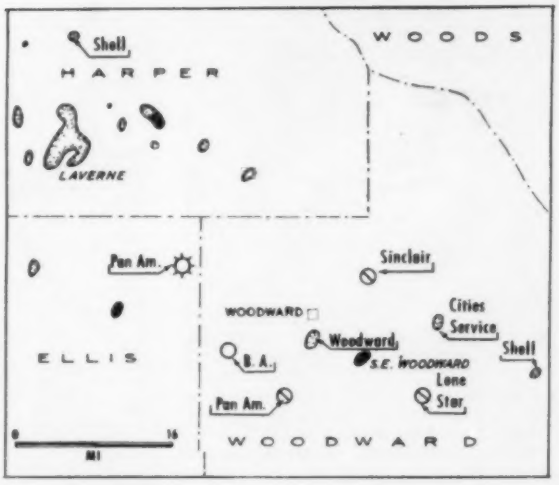
Oklahoma Sees Big Wildcat Surge

By John C. McCaslin
District Editor



Northwestern Oklahoma's Woodward, Ellis, and Harper counties are experiencing a real exploratory surge with success reported at several scattered and important wildcats. Fig. 1.

OKLAHOMA is without a doubt the busiest oil province in the country. The state is enjoying one of its biggest wildcatting sprees in some time with success reported in both old and new areas.

This wildcat surge is centered in the upper reaches of the Anadarko basin, along the highly faulted north flanks of the Wichita Mountains, along the Nemaha granite ridge, the northwestern flank of the McAlester basin, on the Central Oklahoma platform, the Pauls Valley uplift, and in the east corner of the Palo Duro basin.

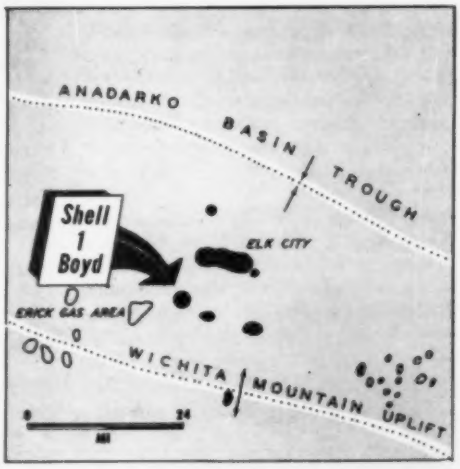
Northwest . . . This section of Oklahoma is fast coming into its own as an oil and gas province of considerable worth. Focal point for the drilling tempo here is Woodward, Harper, and Ellis counties. (Fig. 1).

Cities Service Oil Co. has a Chester-Mississippian oil discovery at 1 Roberts-C. This wildcat plus new drilling throughout the county, particularly south of Woodward along the Morrow trend, make this section one of the state's most closely watched. Pan American Petroleum Corp. 1 Tune is a Morrow and Chester gas discovery in northeastern Ellis County, further enhancing prospects of new fields in northwestern Oklahoma's shelf areas. In Harper County, Shell Oil Co. 1 State was completed flowing 30 bbl. of condensate and 2,820 M.c.f. of gas per day from Chester lime. Wells in the Southeast Stockholm area also give strength to Harper's stock with flows of 700 bbl. per day and more.

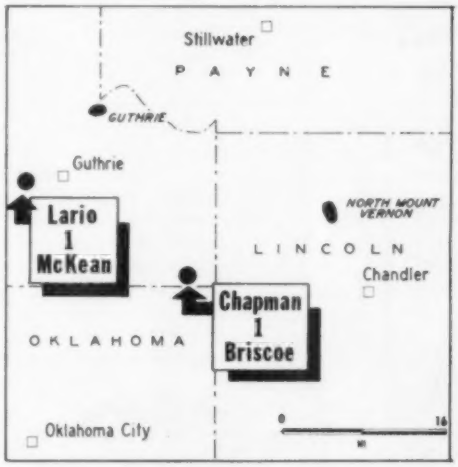
Southwest . . . The most significant discovery in some time in southwestern Oklahoma is Shell Oil Co.'s 1 Boyd, a Beckham County wildcat situated southwest of Elk City field and off the north flanks of the Wichita Mountains. This one flowed 21,000 M.c.f. of gas per day and 400 bbl. distillate from Springer-Penn perforations at 10,212-65 ft. This strike has set off a wave of wildcat enthusiasm in the southwest. Development drilling here could well turn up a sizable new deep reservoir. (Fig. 2).

In Tillman County Bolin Oil Co. and Amerada Petroleum Corp. have a Strawn discovery 12 miles west of Grandfield. The well flowed 14 bbl. per hour. This strike plus continued expansion of Frederick field looks good.

Central . . . This section of the state, long the titleholder of



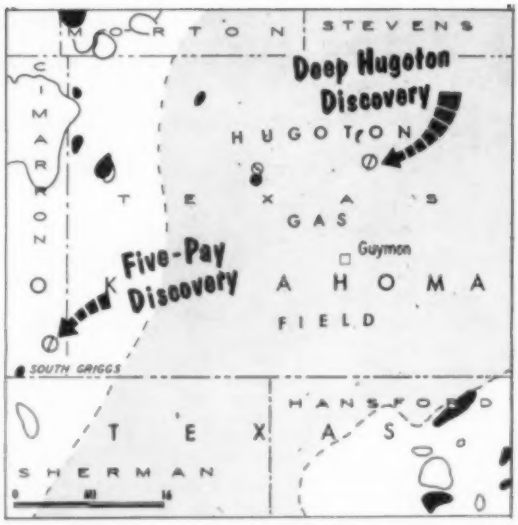
SHELL OIL CO. 1 Boyd, Beckham County Pennsylvanian discovery, flowed 21 M.M.c.f. of gas per day plus 400 bbl. per day from the Springer sand at 10,114-74 ft. Fig. 2.



J. A. CHAPMAN 1 Briscoe is a checkerboard discovery in southeastern Logan County. Lario Oil & Gas Co. 1 McKean, west of Guthrie in Logan County, is a 220-bbl. per day Viola discovery. Mohawk Drilling Co. and Trend Petroleum Co. got an 800-bbl. per day Red Fork sand well in North Mount Vernon field. Apache Oil Co. also extend the field. Fig. 3.

COOPERATIVE REFINERY ASSOCIATION has a five-pay discovery south of Norman in McClain County at 1 Walker-B. Production is from first Bromide, second Bromide, Tulip Creek, McLish, and Oil Creek sands. The Ordovician sands in this section of Oklahoma are fast becoming the No. 1 objective. Fig. 4.

OKLAHOMA NATURAL GAS CO. 1 Popejoy, 20 miles west of Eufaula in McIntosh County, flowed big amounts of gas from the Gilcrease, Union Valley, Cromwell, and Jefferson. Fig. 5.



OKLAHOMA PANHANDLE exploratory success is centered in southeastern Cimarron County in the Griggs area and northeast of Guymon in Texas County. Fig. 6.

wildcat and development leaders, continues to report new fields, pays, and extensions. Busiest field is Mount Vernon in Lincoln County. Development drilling will grow around Chapman's new Logan County discovery at 1 Briscoe. (Fig. 3).

South-Central . . . Cooperative Refinery Association 1 Walker-B in McClain County is this month's wildcat story in southern Oklahoma. The well found production in five Ordovician zones, but will be completed dually in the Bromide and Tulip Creek sands. Oklahoma's search for Ordovician production is fast becoming the exploratory aim of the oil-hunters in the sate. The thick, deep, and virtually unscathed sands of the Ordovician are becoming more and more important as new reserves for the state. (Fig. 4).

Southeast . . . Oklahoma Natural Gas Co. tapped a big gas discovery on the northwest flanks of the long-too-quiet McAlester basin in McIntosh County. Production was found in the Gilcrease, Union Valley, Cromwell, and Jefferson. This one should stir up some drilling in this rig-barren section of Oklahoma. (Fig. 5).

Panhandle . . . The deep search for gas and oil in the Oklahoma Panhandle's pre-Permian zones paid off with a new inside-Hugoton field in Texas County and a five-zone prospect in southeastern Cimarron County. The Texas County discovery is Cities Service 1 Murdock. Production is from basal and upper Morrow-Pennsylvanian sands. The Cimarron wildcat is The Texas Co. 1 Youtsler. Gas and oil have been found in Morrow, Wabaunsee, Lansing-Kansas City, Marmaton, and in an unidentified zone. (Fig. 6).

"I finally sold this to some sucker, O'Hoolihan."

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Potter succeeds Hulcy as . . .

. . . Lone Star's New President

LESTER T. POTTER, the newly elected president of Lone Star Gas Co., is a home-town boy who made good in his home town of Dallas.

Potter has come a long way since the days when he delivered ice in the Oak Cliff area of Dallas. At the time, he was a teen-ager earning money to pay his way through college. Since then, he has climbed up through various departments of Lone Star until being named president in July. At 51, he is one of Lone Star's youngest officials.

He succeeds D. A. Hulcy, who continues as chairman of Lone Star. Hulcy served as president since 1940. He was also named chairman in 1952. Lone Star's directors requested Hulcy remain as chairman "even beyond his normal retirement date of December 1, 1957."

Lone Star career . . . Potter joined Lone Star in 1928 the day he received his mechanical-engineering degree from Texas A. & M. College.

The gas company signed up its future president just before he left A. & M. Potter was among a group of engineers attending a test at the College Station power plant to see if the plant could be economically converted to natural gas from lignite. During the test, Lone Star offered him a job.

Potter was assigned to handle special gas-well engineering problems in West Texas and was given the title of siphon inspector. The work Potter and others did in West Texas led to the formation of a production-engineering department in 1931. When the department was set up, Potter was named an assistant production engineer.

In later years Potter also served as superintendent of production and assistant to the superintendent of the transmission division. He joined Lone Star's management team in 1947 when Hulcy picked him as assistant to the president. And Potter moved up again in 1954 when he was named executive vice president.

Started working early . . . Potter was only 15 when he started delivering ice. He worked a 10-hour day that began at 4 a.m. He earned $3.50 a day plus a 5-cent commission for each 100 lb. of ice he sold in residential areas and 2½ cents for sales to business houses.

Potter worked during summer school vacations for 7 years to finance his college education.

The new Lone Star president comes from a pioneer Dallas family. He was born and grew up in the Thomas Hill area of Oak Cliff. Thomas Hill is named after his maternal grandfather, J. D. Thomas, a Bryan lawyer who moved his family to Dallas in 1890.

LESTER T. POTTER
. . . from ice man to company president.

While becoming a business success in Dallas, Potter also has worked hard with civic and church projects. He is a Sunday-school teacher and lay official of the Kessler Park Methodist Church and has been a leader in many of Dallas' civic organizations.

He also is a director of the Dallas Petroleum Club and chairman of the American Gas Association's economics committee.

Ralph H. Starrett, Kansas City; **Spencer A. Hallberg,** Chicago; and **Norman F. Tietze,** Minneapolis, have been named pipeline division managers for Standard Oil Co. (Ind.). All three were division superintendents. The changes are part of the company's consolidation of six district offices in the Midwest marketing area into three division offices. In other appointments, **Francis W. Mann,** Chicago; **James L. Ashworth,** Kansas City; and **Herbert W. Wilker,** Minneapolis, have been named division superintendents. They were formerly district superintendents, Mann at Council Bluffs, Iowa; Ashworth at Moorhead, Minn.; and Wilker at Jackson, Mich. New mechanical division superintendents, all formerly division master mechanics, are **Alvis F. Smith,** Chicago; **Hugh Patterson,** Kansas City; and **Virgil J. Hansen,** Twin Cities.

Personals

Julius Babisak has been appointed district geologist at Atlantic Refining Co.'s new Alberta division headquarters in Calgary.

Norman C. Miller will become acting chief geologist for Delhi-Taylor Oil Corp. October 1. He has been staff geologist for the company in Dallas for the past several months.

Arnold Radke has been promoted to general drilling superintendent of Garvey Drilling Co., Wichita, Kans. **Calvin Roberts** has been named drilling superintendent for the company's Kansas-Oklahoma district.

Hugh M. Looney, district geologist for British-American Oil Producing Co. in Fort Worth, has been promoted to southwestern division geologist in Midland, Tex. The company's district exploration office in Fort Worth has been closed.

C. J. McGinnis, The California Co.'s district exploration superintendent in Denver, has been transferred to Billings, Mont., as division exploration superintendent. **S. K. Frazier,** Montana district exploration superintendent, will succeed McGinnis in Denver.

Merrill W. Haas, exploration manager and a director of Carter Oil Co., has been elected a vice president of the company. Haas has been with Standard Oil Co. (N.J.) affiliates since 1933. He began with Humble Oil & Refining Co., later spent several years in Venezuela with Lago Petroleum Corp., Standard Oil Co. of Venezuela, and Creole Petroleum Corp., all Jersey Standard affiliates. In 1951 he was named chief geologist for Carter. He has been exploration manager since 1954 and a director since last year.

H. J. (Jim) Barton, formerly chief of the petroleum economics branch in the Department of Interior's Bureau of Mines, has transferred to the programing division of the Office of Oil and Gas. He will work mainly on the import problem. **Donald S. Colby,** chief of the economic analysis and forecast section, will succeed Barton as chief of the Bureau of Mines' petroleum economics branch. **J. G. Kirby** has succeeded Colby as chief of economic analysis and forecast.

Personals

E. Clyde Seymour has been named senior vice president of Magnolia Petroleum Co. Seymour moves up from his post as vice president, a position he has held since 1946. Seymour's service with Magnolia stretches back to 1912 when he started work as a messenger boy. He is the only active member of the organization who saw service with the company headquarters before it was moved to Dallas from Corsicana, Tex., in 1914.

Wilson B. Swan has been transferred by Humble Oil & Refining Co. from Houston to Beaumont, Tex., as senior petroleum engineer.

Walter Paltz and **Bob Carrier** have been appointed engineering associates, and **Lee Beach** has been named research associate with Esso Research & Engineering Co.

William G. Eastman, secretary-treasurer of O. R. Burden Construction Corp., Tulsa, will be his company's representative at the 13-week advanced management program of Harvard Graduate School of Business Administration this fall. Eastman, a graduate of the University of Tulsa, has been with Burden since 1950.

J. R. McMurray, district geologist for The Texas Co. at Midland, Tex., has been transferred to Fort Worth as assistant division geologist. He succeeds **J. L. Sleeper, Jr.,** recently transferred to New York as staff geologist. **W. J. Vaughn,** district geologist at Wichita Falls, Tex., has been moved to Midland in the same capacity, replacing McMurray. **John H. Bass** has been promoted from staff geologist at Midland to district geologist at Wichita Falls replacing Vaughn.

Lloyd L. Reynolds will be assistant manager at Ethyl Corp.'s San Francisco manufacturing plant now under construction at Pittsburg, Calif. Others assigned to the new plant include **Feltus H. Wade,** maintenance superintendent; **James E. Rogers,** operating supervisor; **Earl S. Wirtz,** industrial engineer; **Robert D. Sinner,** engineering superintendent; **Walter G. Weakley,** purchasing agent; **G. L. James,** engineer inspector; **Orland W. Cooper,** plant chemist; and **John Elder,** supervisor of maintenance.

E. R. Muckelrath, tool pusher for Penrod Drilling Co., has been transferred to Bottineau, N. D., from Ray, N. D.

Gilbert C. Bower has been transferred by Transcontinental Production Co. to Scranton, Pa., from Romney, W. Va. He is field engineer.

O. Q. Lomax, who retired recently as president of Humble Pipe Line Co., is opening an office as a pipeline consultant October 1 in Houston.

Jack Willard Kelly has been transferred from Mobil Producing Co. to General Petroleum Corp. as senior foreman in the production department at Big Piney, Wyo.

Robert Q. Bussell has joined Pure Oil Co. in Tulsa as division staff petroleum engineer. He was formerly secondary-recovery engineer with Gulf Oil Corp.

E. D. Haverland has joined Alberta Gas Trunkline Co., Ltd., as district superintendent in Oyen, Alta. **C. T. McCall** has been appointed measurement superintendent in Cavendish, Alta. Haverland was formerly with Transcontinental Gas Pipe Line Corp. McCall has been with Canadian Western Natural Gas Co., Ltd., in Calgary. Alberta Gas Trunkline recently began operations.

Herbert L. McCracken has been transferred by Ambassador Oil Corp. from the Roswell, N. M., office to the Fort Worth headquarters and promoted to chief engineer of the firm's secondary-recovery department and assistant superintendent of water-flooding operations. He succeeds **B. J. Kellenberger** who has been named assistant to the president in charge of property acquisition and contracts. **Kenneth D. Myrick** at the same time was promoted from water-flood project supervisor to district supervisor for West Texas at Monahans. **E. W. Rickey,** Bartlesville, Okla., was named district supervisor of water floods in southeastern Kansas and northeastern Oklahoma; **Wayne Capron** was transferred from Abilene, Tex., to Artesia, N. M., as project supervisor of newly acquired water-flood properties in the Artesia area; **Don Layton,** project engineer, was moved from Ottawa, Kans., to Caprock, N. M., as water-flood project supervisor; and **H. O. Murphy** was transferred from Independence, Kans., to Brownwood, Tex., as project supervisor of Ambassador's Brown County water floods.

W. D. Horton has been promoted to district petroleum engineer in Long Beach, Calif., for The Texas Co. He was formerly area petroleum engineer there.

Keith L. Diehl, formerly manager of drilling and production for Edwin W. Pauley at San Antonio, Tex., has been elected vice president of Drilling & Exploration Co. of Delaware, Inc., at Dallas.

Robert E. Thompson, process engineer with Pacific Northwest Pipeline Co. in Durango, Colo., has been transferred to Odessa, Tex., as process engineer with El Paso Natural Gas Products Co.

E. W. Dissler, Cities Service Oil Co.'s assistant chief geologist, has been named resident manager of Canada-Cities Service Petroleum Corp. with headquarters in Calgary. Dissler has been with the company since 1940. He was division manager in Calgary with the Canadian firm before transferring to Bartlesville, Okla., as the parent company's assistant chief geologist 3 years ago. **Murray G. Wells,** manager of exploration in the Mid-Continent division, will succeed Dissler as assistant chief geologist. Wells was Rocky Mountain division geologist and northwestern division exploration manager before his Mid-Continent assignment. **Barron Housel,** assistant superintendent of the land department, will succeed Wells as Mid-Continent division manager of exploration.

E. W. DISSLER

M. G. WELLS

Ralph D. Webb, head of the instrument department of Union Carbide Chemicals Co.'s South Charleston, W. Va., plant, has been elected to honorary membership in Instrument Society of America in recognition of his contributions to instrumentation and automatic control. **Henry C. Frost,** assistant chief engineer of Corn Products Refining Co., was elected president-elect-secretary of I.S.A. at its annual meeting recently. Frost will succeed **Robert J. Jeffries** as president next year. Jeffries, assistant to the president of Daystrom, Inc., and 1957 president-elect-secretary, took over as I.S.A. president at the annual meeting.

Personals

W. R. Huber has been named director of the petroleum industry's centennial celebration in 1959 and will act as chief executive officer of the American Petroleum Institute's centennial working committee. Huber, director of public relations for Gulf Oil Corp., has been given a leave of absence by his company and will headquarter in the New York offices of A.P.I. Huber joined Gulf in 1935 as advertising and sales promotion manager. He has served as the company's general manager of retail marketing as well as public-relations director. Active in A.P.I. affairs, he was chairman of the Oil Information Committee's advertising subcommittee for several years and was national O.I.C. chairman in 1955.

Orval Denman has resigned as a geologist at San Angelo for Mark A. Eidelbach to join Christie, Mitchell & Mitchell at Bridgeport, Tex., in the same capacity.

Thomas W. Phelps, assistant to the board chairman of Socony Mobil Oil Co., Inc., New York, has been elected 1958 national chairman of the Oil Information Committee. He succeeds **M. S. Hauser,** Ohio Oil Co. public-relations director. Elected vice chairmen of O.I.C. were **R. H. Collacott,** Standard Oil Co. (Ohio), Cleveland; **Russell D. Karns,** Pan American Petroleum Corp., Tulsa; **G. A. Mabry,** Humble Oil & Refining Co., Houston; and **Stewart Schackne,** Standard Oil Co. (N. J.), New York. **Donald R. Waugh** of O.I.C.'s New York staff has been elected secretary.

J. William Schmotzer has moved up from assistant chief geologist to chief geologist of Arkansas Fuel Oil Corp. **Dr. J. K. Rogers,** manager of the company's Ark-La-Tex division office, has been named regional geologist. Both men will headquarter in Shreveport, La., at the company's home offices. In other changes, Arkansas Fuel Oil promoted **A. V. Hargis,** manager of the Lafayette, La., office, to manager of the Ark-La-Tex exploration division, succeeding Rogers. **K. S. Briggs,** division geologist at Lafayette, has moved up to division exploration manager in Jackson, Miss. **J. C. Bianchi,** division geologist in San Antonio, Tex., has been named division manager in Lafayette, succeeding Hargis. **L. B. Smith, Jr.,** manager of the Jackson, Miss., office, has been transferred to Shreveport as division geologist.

Troy Rogers, drilling superintendent with Miracle-Fifer Drilling Co., has been transferred to Denver from Sterling, Colo.

Glenn Staley, pioneer conservationist, will retire October 1 as director of the New Mexico Oil and Gas Engineering Committee at Hobbs. Staley has been active in petroleum conservation since 1919 when he became assistant state geologist and oil and gas inspector in Wyoming in the first conservation program of its kind in the U.S. He later became New Mexico state geologist. In 1930 he was proration umpire for a committee which now, as the oil and gas engineering committee, has 200 member operators. The veteran conservationist was honored at a testimonial dinner in Santa Fe September 17.

J. B. Saunders, president of Triangle Refineries, Inc., and a senior vice president of Kerr-McGee Industries, Inc., and **Breene M. Kerr,** systems-evaluation engineer for Kermac, have been elected directors of the company. In 1937 Saunders was one of the founders of Triangle Refineries, which was purchased several months ago by Kerr-McGee. Kerr, a graduate of Massachusetts Institute of Technology, joined the company in 1953. He is the son of **Sen. Robert S. Kerr,** founder and chairman of the board of Kerr-McGee.

Thomas M. Hendrickson has been named Gulf Coast division geologist for Rimrock Tidelands, Inc. Hendrickson was formerly division geologist for Frankfort Oil Co. and before that was with Union Producing Co. and Pure Oil Co. in the Gulf Coast area. He is a graduate of the University of Indiana and Louisiana State University.

C. R. Elder has moved up from superintendent of Sohio Pipe Line Co.'s Tri-State division, Grayville, Ill., to general superintendent of the company. He will headquarter in St. Louis. **A. D. Dorris,** assistant superintendent of Sohio's products pipeline division in Fostoria, Ohio, will succeed Elder as Tri-State division superintendent. Elder has been with the company since 1947. He was superintendent of the southwestern division before becoming Tri-State superintendent. Dorris has been with Sohio since 1948. He was appointed assistant superintendent of the products-pipeline division last year.

DEATHS

G. M. D. (Pat) Blackstock, 36, general counsel of British American Oil Co., Ltd., died recently in Edmonton. A graduate of the University of Alberta, Blackstock joined Canadian Gulf in 1954 before the company was taken over by British American.

B. C. (Buster) Lomax, 32, **Pete Lomax,** 42, and **Dell Taylor,** 37, were killed September 14 in the crash of a single-engine private plane 20 miles south of Monahans, Tex. The Lomax brothers were owners of Curtis & Lomax Drilling Co., Midland, Tex. Taylor was sales engineer at Midland for BJ Service, Inc.

Russell W. Shaw, 64, Mattoon, Ill., independent operator, died recently of a heart attack in his car near Chicago. Shaw had been an oil operator in Denver, Wichita, Tulsa, Jackson, Miss., and Mattoon.

Forrest H. (Ted) Harwell, 40, Wichita Falls, Tex., independent oil producer, was killed September 13 when his light plane crashed near Chandler, Okla.

Charles Chester Kearns, 73, Nowata, Okla., retired superintendent of the old Major Oil Co., died September 15 in Tulsa. Kearns entered the oil business in 1907 as a roustabout. He was named superintendent of Major Oil in 1949 and retired in February of this year when Major sold its interests.

John F. Melvin, 69, of Newaygo, Mich., independent operator in the Michigan area since 1929, died September 9. Melvin was one of the survivors of the McClanahan-Struble fire in Greendale field in 1931, when 10 persons were fatally injured.

W. E. (Bill) Powell, 39, Bradford, Pa., general sales manager for Birdwell, Inc., died September 14 after an auto accident.

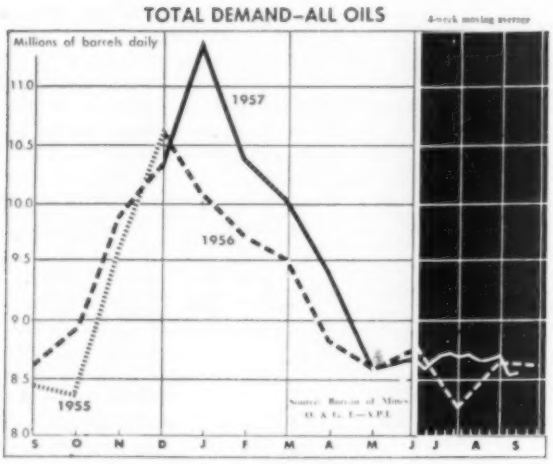
Andrew C. Marshall, 66, retired assistant treasurer of Union Oil Co., Los Angeles, died September 12. Marshall retired in 1946.

Sid Roberts, 60, Abilene, Tex., independent, died September 10 in Abilene.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,811,340	DOWN	8,620	DOWN	245,680
Crude stocks	282,482,000	DOWN	1,741,000	UP	9,017,000
Completions	1,057	DOWN	69	DOWN	22
Refinery runs	8,056,000	DOWN	214,000	DOWN	22,000
Gasoline stocks	173,805,000	UP	253,000	DOWN	1,962,000
Kerosine stocks	36,001,000	UP	1,174,000	UP	2,289,000
Distillate stocks	162,853,000	UP	2,967,000	UP	16,748,000
Residual stocks	55,183,000	UP	1,164,000	UP	6,907,000
Four-product stocks	427,842,000	UP	5,558,000	UP	23,982,000
Total imports	1,332,500	DOWN	462,700	DOWN	161,000



Changes in the National Economy Will Influence Next Year's Oil Demand

IT WILL PAY you to keep a weather eye on general economic indicators for the next few months. They may give you a hint of next year's demand for petroleum products.

While it is true that shifts in the over-all economy will not affect oil demand as much as they will demand for durable goods, any important change will influence oil operations.

The tables at the bottom of the page show changes for two of the more important indicators. These are the Federal Reserve Board's Index of Industrial Production and the Department of Commerce's Record of Personal Income.

The Index of Industrial Production measures changes in total industrial activity. Any important shift will be reflected in the industrial demand for residual and distillate fuels and to a lesser extent in the demand for gasoline.

For example, the FRB index dropped 6.7 per cent in 1954. Domestic demand for residual fuels was off 6.8 per cent that year. The correlation will not always be that close, but any big drop in industrial production will cut sales of residual. Some forecasters are predicting that the production index will still be below 145 at the end of the year. December was 147 last year.

Demand for gasoline is influenced more by total personal income. Gasoline demand was up 6.2 per cent in 1953. Personal income rose 5.2 per cent. The following year personal income gained only 0.2 per cent and gasoline demand increased only 0.2 per cent.

Distillate demand this winter will be influenced more by the weather than by either personal income or industrial production. Since the weather was warmer than normal last winter, average temperatures and a gain in the number of burners would guarantee good gains in distillate sales.

Refiners with full distillate tanks would welcome a colder-than-average winter this year.

FEDERAL RESERVE BOARD'S INDEX OF INDUSTRIAL PRODUCTION

(1947-49 = 100, seasonally adjusted)

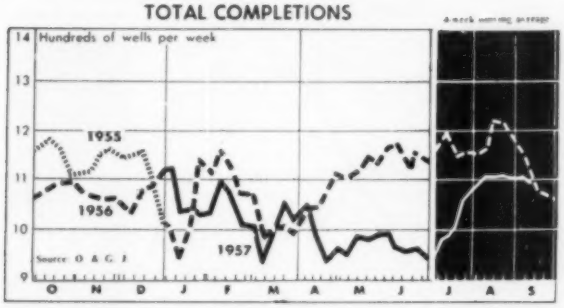
	1953	1954	1955	1956	1957
January	134	125	132	143	146
February	134	125	133	143	146
March	135	123	135	141	145
April	136	123	136	143	143
May	137	125	138	141	143
June	136	124	139	141	144
July	137	123	139	136	144
August	136	123	140	143	
September	133	124	142	144	
October	132	126	143	146	
November	129	128	144	146	
December	126	130	144	147	
Year	134	125	139	143	

PERSONAL INCOME

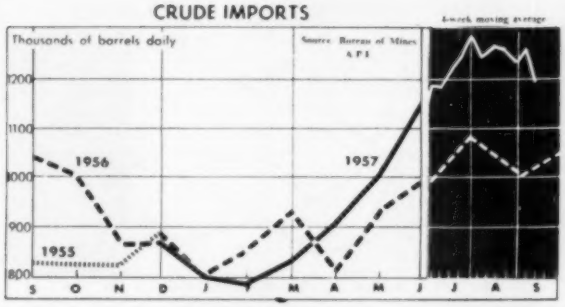
(Billions of dollars, annual rate seasonally adjusted)

	1953	1954	1955	1956	1957
January	281.1	285.2	292.2	316.7	335.9
February	282.0	286.3	293.2	317.1	337.9
March	285.0	286.3	295.7	318.6	339.5
April	285.5	286.4	298.9	321.7	340.6
May	286.6	286.7	301.4	322.8	342.9
June	288.2	286.7	301.6	324.9	344.8
July	288.9	287.1	305.3	324.3	345.5
August	287.6	286.7	305.3	328.1	347.3
September	287.9	287.9	307.9	329.5	
October	288.9	288.4	309.2	332.5	
November	287.3	290.8	312.0	333.5	
December	285.9	293.4	314.8	334.0	
Year	286.0	287.4	305.9	326.9	

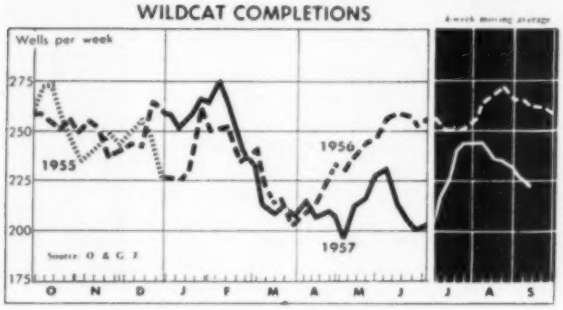
TOTAL COMPLETIONS



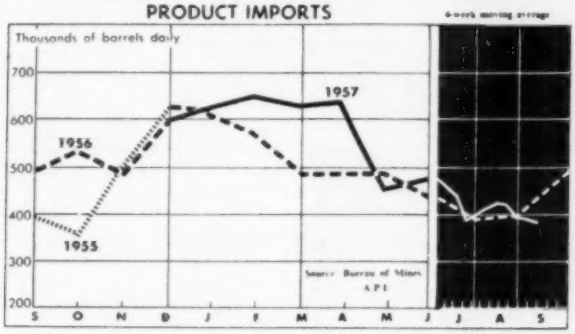
CRUDE IMPORTS



WILDCAT COMPLETIONS



PRODUCT IMPORTS

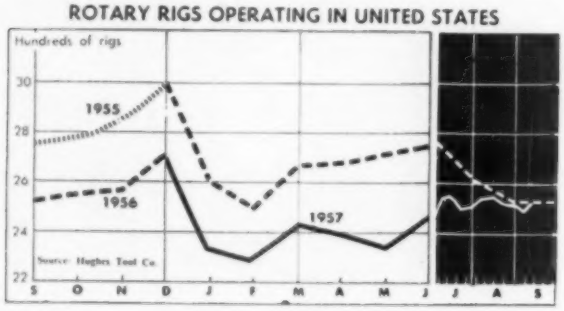


WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 14, 1957

	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1957	1956	Total	Crude	Cond.	Gas	Dry	1957	1956
Alabama	0	0	0	0	0	0	0	63	‡77	0	0	0	0	0	20	‡34
Arkansas	25	16	0	1	8	0	90,158	784	620	4	0	0	1	3	140	133
California	56	47	0	2	7	0	277,935	1,519	1,576	9	1	0	1	7	372	364
Colorado	20	5	0	3	12	0	116,573	599	824	12	1	0	0	11	403	431
Illinois	50	30	0	0	20	0	109,258	1,811	2,706	4	0	0	0	4	446	533
Indiana	10	2	0	0	8	0	14,044	457	475	4	0	0	0	4	92	98
Kansas	67	32	0	4	31	0	235,033	2,968	3,579	15	1	0	0	14	594	759
Kentucky	32	8	0	1	23	0	31,911	1,026	1,299	12	1	0	0	11	212	307
Louisiana	90	40	0	10	40	0	744,089	2,655	2,711	15	1	0	2	12	473	549
North	27	14	0	3	10	0	99,543	954	1,166	5	1	0	1	3	128	185
South	46	20	0	5	21	0	473,949	1,220	1,241	10	0	0	1	9	287	309
Offshore	17	6	0	2	9	0	170,597	481	304	0	0	0	0	0	58	55
Michigan	16	12	0	0	4	0	46,928	296	316	4	0	0	0	4	107	123
Mississippi	11	2	0	0	9	0	81,665	270	318	4	0	0	0	4	141	151
Montana	9	0	0	2	7	0	44,210	284	317	7	0	0	1	6	105	118
Nebraska	10	3	0	0	7	0	60,151	612	707	7	1	0	0	6	340	350
New Mexico	39	15	2	14	8	0	198,888	1,500	1,367	6	1	0	0	5	200	183
Northwest	20	3	2	13	2	0	97,467	612	575	3	1	0	0	2	75	62
Southeast	19	12	0	1	6	0	101,421	888	792	3	0	0	0	3	125	121
New York	9	4	0	0	0	5	9,250	326	....	0	0	0	0	0	6	....
North Dakota	4	2	0	0	2	0	22,602	185	181	2	0	0	0	2	79	57
Ohio	8	3	0	1	3	1	19,969	777	750	0	0	0	0	0	9	7
Oklahoma	131	75	0	1	44	11	428,475	4,418	6,069	10	2	0	0	8	505	643
Pennsylvania	0	0	0	0	0	0	0	473	†762	0	0	0	0	0	39	†19
Texas	404	235	10	17	136	6	1,577,383	15,387	15,887	83	9	2	0	72	3,730	4,015
Dist. 1	17	7	0	0	10	0	44,583	882	*2,293	5	0	0	0	5	307	*774
Dist. 2	11	1	1	4	5	0	68,357	535	*1,889	3	0	1	0	2	197	*611
Dist. 3	26	9	2	0	15	0	162,836	1,220	....	9	0	1	0	8	351	....
Dist. 4	26	11	1	2	12	0	141,450	998	....	8	0	0	0	8	333	....
East	32	19	2	0	10	1	158,926	926	829	8	0	0	0	8	269	298
Dist. 7-B	85	45	0	2	38	0	237,805	2,035	....	20	6	0	0	14	710	....
West	100	74	2	0	20	4	420,914	4,355	4,255	13	1	0	0	12	623	664
Dist. 9	83	58	0	3	21	1	227,121	3,425	*5,670	15	2	0	0	13	865	*1,583
Dist. 10	24	11	2	6	5	0	115,391	1,011	951	2	0	0	0	2	75	85
Utah	2	1	0	0	1	0	12,410	145	89	0	0	0	0	0	75	53
West Virginia	23	4	0	16	3	0	63,511	471	472	1	0	0	0	1	21	15
Wyoming	13	5	0	2	5	1	70,664	605	586	4	1	0	0	3	207	163
Misc. (Tenn.)	28	0	0	3	25	0	47,572	99	70	28	0	0	3	25	82	62
Total U. S.	**1,057**	541	12	77	403	24	4,302,679	37,730	41,758	**231**	19	2	8	202	8,398	9,167
Total prev. week	1,126	591	9	79	415	32	4,349,475	.....	.....	213	21	1	6	185	.....	.....
Cum. 1957	37,730	19,574	345	2,714	14,308	789	155,768,346	.....	.....	8,398	857	69	300	7,172	.....	.....
Western Canada	50	42	0	1	7	0	240,545	2,131	2,179	10	4	0	1	5	596	....

*Districts: 2 & 3, 1 & 4, 9 & 7-B, formerly combined. †Incl. New York. ‡Incl. Florida and Georgia.

ROTARY RIGS OPERATING IN UNITED STATES

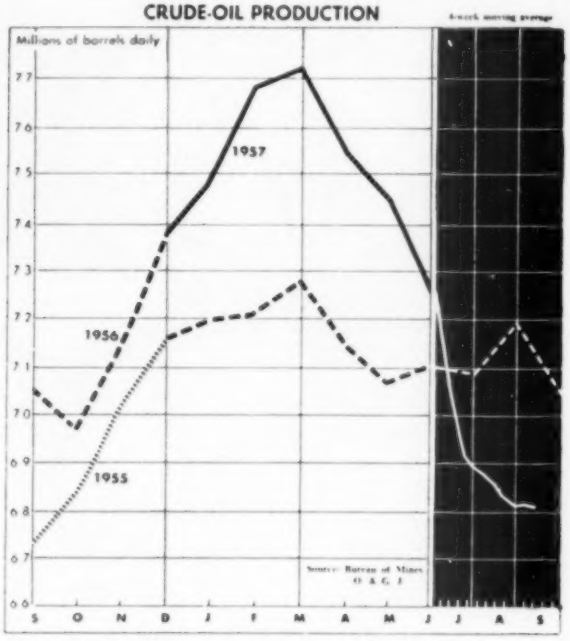


ACTIVE ROTARY RIGS*

Colorado	65	63	65	64
Florida	1	1	1	2
Georgia				
Area—	9-16-57	9-9-57	9-2-57	9-17-56
Alabama	4	4	3	8
Arkansas	25	26	27	21
Arizona	1			
California	96	94	98	109
Idaho				
Illinois	67	54	58	64
Indiana	11	8	7	13
Iowa	2	2	2	1
Kansas	151	151	153	155
Kentucky	12	10	12	9
Louisiana	450	442	439	436
North	62	67	64	63
South	285	276	272	373
Offshore	103	99	103	(†)
Maryland	1	1	1	
Michigan	11	13	15	13
Missouri				1
Montana	30	26	23	47
Mississippi	38	42	43	21
Nebraska	34	36	36	27
Nevada				1
New Mexico	149	153	164	136
New York				
North Dakota	39	37	37	24
Ohio				1
Oklahoma	271	255	243	258
Oregon	1	1	1	
Pennsylvania	13	14	14	8
South Dakota	2	1		
Texas	908	910	923	981
Gulf Coast	203	201	195	245
Offshore	2	4	3	(‡)
West	363	361	374	368
North	280	292	296	301
East	60	52	55	67
Tennessee	1	1	1	
Utah	67	68	66	19
Washington	1	1	1	
West Virginia	4	4	4	2
Wloming	79	76	73	82
Virginia	1	1	1	
Total United States	2,535	2,495	2,511	2,513
Western Canada	208	205	192	248
Eastern Canada	3	3	3	
Grand total	2,746	2,703	2,706	2,761

*Hughes Tool Co. †Included with South Louisiana. ‡Included with Texas Gulf Coast.

CRUDE-OIL PRODUCTION

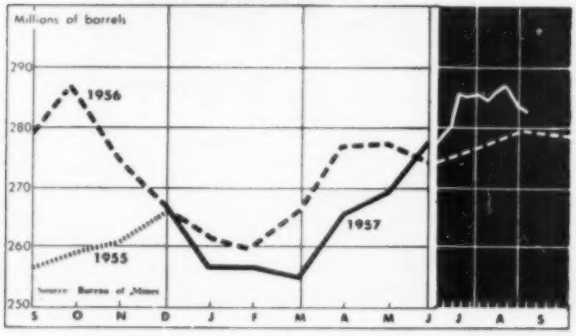


DAILY AVERAGE PRODUCTION FOR WEEK

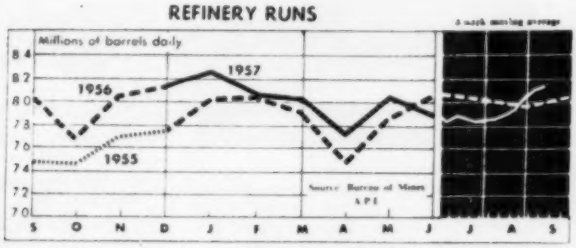
	September 14, 1957			Sept. 7
	Crude oil	Lease condensate	Total	total
Alabama	15,440		15,440	14,680
Arkansas	80,530	220	80,750	80,890
California	926,400		926,400	924,600
Colorado	148,430		148,430	149,000
Eastern	52,100		52,100	52,500
Florida	1,250		1,250	1,250
Illinois	219,500		219,500	215,500
Indiana	33,700		33,700	37,500
Kansas	†326,000		†326,000	†326,590
Kentucky	46,500		46,500	46,800
Louisiana	712,700	70,400	783,100	784,000
North	122,700	2,400	125,100	126,000
South	590,000	68,000	658,000	658,000
Michigan	28,300		28,300	26,800
Mississippi	99,275	4,275	103,550	103,550
Montana	75,750		75,750	75,650
Nebraska	55,400		55,400	55,100
Nevada	100		100	100
New Mexico	249,290	3,700	252,990	251,900
North Dakota	37,300		37,300	38,100
Oklahoma	†549,500		†549,500	†560,300
Texas	2,720,000	54,400	2,774,400	2,774,400
Dist. 1	49,500	500	50,000	50,000
Dist. 2	125,500	8,600	134,100	134,100
Dist. 3	393,000	26,800	419,800	419,800
Dist. 4	207,000	6,100	213,100	213,100
Dist. 5	35,500	275	35,775	35,775
Dist. 6	120,500	5,900	126,400	126,400
East Texas Field	170,500		170,500	170,500
Dist. 7-B	153,000	50	153,050	153,050
Dist. 7-C	142,000	3,675	145,675	145,675
Dist. 8	1,012,000	1,400	1,013,400	1,013,400
Dist. 9	204,500	600	205,100	205,100
Dist. 10	107,000	500	107,500	107,500
Utah	10,830		10,830	11,350
Wyoming	289,850		289,850	289,150
Others	‡200		‡200	‡250
Total U. S.	6,678,345	132,995	**6,811,340**	6,819,960
Change from previous week, down			**8,620**	
Canada	†476,500		†476,500	†458,000
Total U. S. production—Jan. 1-Sept. 14			1,877,162,225 bbl.	
Same period last year (crude plus cond.)			*1,845,276,599 bbl.	

*Includes 31,655,855 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

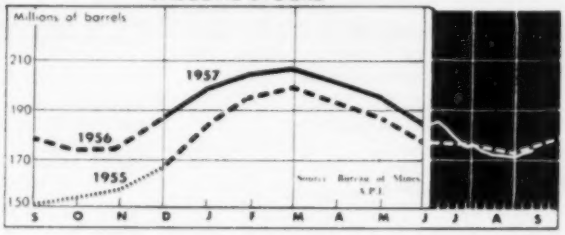
CRUDE-OIL STOCKS



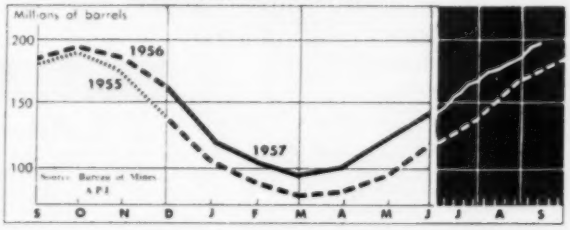
REFINERY RUNS



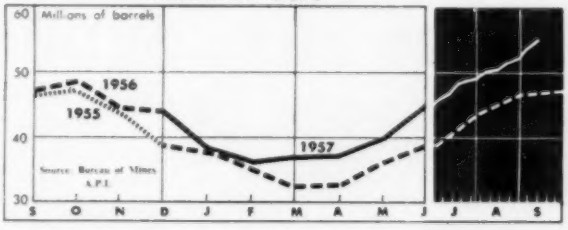
GASOLINE STOCKS



MIDDLE-DISTILLATE STOCKS



RESIDUAL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	9-7-57	8-31-57	9-8-56
Pennsylvania Grade	3,230	3,173	2,543
Other Appalachian	1,667	1,606	2,444
Illinois, Indiana, and Michigan	11,186	11,105	11,000
Nebraska and North Dakota	2,413	2,621	2,455
Kansas	10,392	11,000	10,002
Oklahoma	21,650	21,555	26,603
Arkansas	2,727	2,815	2,840
Louisiana	18,966	18,840	17,661
North	3,144	2,980	2,594
South	15,822	15,860	15,067
Mississippi, Alabama, and Florida	2,607	2,581	2,957
New Mexico	9,797	8,923	8,239
Texas	126,524	129,523	120,920
East Texas proper	10,332	10,161	8,964
West Texas	60,273	62,851	57,776
Texas Gulf	23,754	24,195	23,109
Other Texas	32,165	32,316	31,071
Wyoming	17,008	17,342	17,229
Other Rocky Mountain	6,324	6,065	6,326
California	30,684	30,458	27,775
Foreign	†17,307	16,616	14,471
Total	282,482	284,223	273,465

*Bureau of Mines. †Includes 4,783,000 bbl. in California.

A.P.I. REFINERY REPORT, SEPTEMBER 13, 1957

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, September 1956 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,195	505.0	29.4	296.6	240.3	41,945	14,690	60,459	13,545	1,105	467.3	29.3	306.1	174.8
Appalachian														
District 1	112	47.7	3.0	24.7	7.4	4,403	698	3,388	590	106	44.7	4.8	15.1	4.3
District 2	94	51.3	7.9	11.0	8.7	2,649	670	986	195	98	52.3	3.5	16.8	12.6
Ind., Ill., Ky.	1,431	722.0	73.9	301.6	149.4	29,780	7,032	23,197	5,314	1,451	764.4	70.4	307.2	147.3
Minn., Wis., Dak.	78	37.1	2.4	28.9	7.0	5,954	1,674	7,794	490	91	43.0	5.4	23.8	8.8
Okla., Kans., Mo.	727	420.2	14.4	186.3	27.3	13,990	1,934	14,918	1,042	671	374.5	14.0	165.8	25.9
Inland Texas	307	230.0	8.1	50.0	23.9	6,550	476	2,725	1,965	282	208.4	7.8	53.5	22.3
Texas Gulf Coast	1,849	957.7	115.3	457.1	229.6	23,333	3,371	18,924	8,300	1,944	917.2	116.9	482.8	245.7
La. Gulf Coast	646	386.0	64.7	152.4	53.7	9,778	3,729	7,961	1,719	699	347.4	59.2	197.0	49.7
N. La. and Ark.	96	31.0	7.7	19.7	5.9	3,914	972	2,174	169	103	40.1	8.2	23.3	5.4
Rocky Mountain:														
New Mexico	22	11.3	0.7	4.3	4.0	415	10	82	77	24	13.0	0.3	4.8	3.2
Other Rocky Mtn.	292	138.7	2.9	69.6	38.7	5,547	331	3,279	954	269	127.9	5.1	57.9	33.9
West Coast	1,207	540.0	3.9	166.1	310.0	25,547	414	16,966	20,823	1,181	502.3	4.2	181.0	328.4
Sept. 13, 1957	8,056	4,078.0	334.3	1,768.3	1,105.9	173,805	36,001	162,853	55,183	8,024	3,902.5	329.1	1,845.1	1,062.3
Sept. 6, 1957	8,270	4,208.1	278.9	1,872.4	1,184.9	173,552	34,827	159,886	54,019					
Sept. 14, 1956	8,078	3,932.0	318.9	1,809.0	1,107.1	175,767	33,712	146,105	48,276					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	11.50-11.75
Premium (98 octane)	14.25-14.50
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	12.75-13.25
Premium (98 octane)	13.00-13.50
California (rack):	
Regular (88 octane)	12.9
Premium (96 octane)	14.9
Premium (98 octane)	15.4
Caribbean area (cargoes):	
Regular (87 octane)	10.875
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.0
Breckenridge:	
Grade 26-70	3.5

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.50-10.00
Diesel oil (58 d.i. and above)	9.125-9.75
Distillate No. 1	9.125-9.75
Distillate No. 2	8.50-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	8.75-9.50
Distillate No. 2	8.75-9.50
New York Harbor (barges):	
Kerosine 41-43	10.75
Distillate No. 2	10.25
Diesel fuel, 48-52 d.i.	10.55
Caribbean area (cargoes):	
Distillate No. 2	9.00

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.75-2.00
Gulf Coast (cargoes):	
Bunker C fuel	$2.50-2.75
New York Harbor (barges):	
Bunker C fuel	$2.95
Caribbean (cargoes):	
Bunker C	$2.55
California (rack):	
Bunker C fuel, Los Angeles	$2.85-3.00

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	25.5
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	22.25
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	28
200 vis. neutral (180 at 100°), 25 p.t.	26

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.67				
15-15.9	2.71				$1.89
16-16.9	2.74				1.94
17-17.9	2.78				1.99
18-18.9	2.82				2.04
19-19.9	2.85				2.09
20-20.9	2.89	$2.75		$2.62	2.14
21-21.9	2.93	2.77		2.64	2.19
22-22.9	2.97	2.79		2.66	2.24
23-23.9	3.01	2.81	$3.44	2.68	2.29
24-24.9	3.05	2.83	3.46	2.70	2.34
25-25.9	3.09	2.85	3.48	2.72	2.39
26-26.9	3.13	2.87	3.50	2.74	2.44
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95		2.82	2.63
31-31.9	3.38	2.97		2.84	2.67
32-32.9	3.44	2.99		2.86	2.71
33-33.9	3.50	3.01		2.88	2.75
34-34.9	3.56	3.03		2.90	2.79
35-35.9	3.61	3.05		2.92	2.83
36-36.9	3.65	3.07		2.94	2.87
37-37.9	3.68	3.09		2.96	2.89
38-38.9		3.11		2.98	2.91
39-39.9		3.13		3.00	2.93
40 and up		3.15		3.02	2.95

*Includes Oklahoma, part of Kansas, North Dakota, West Texas (sweet) and North Central Texas. †Low cold test Gulf Coast. ‡Sour.

Effective dates: California January 17, 1957, east of California, January 3-January 10, 1957; Pennsylvania Grade, July 26, 1957.

Some crudes in North Central Texas and West Central Texas, are on the intermediate schedules.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.65
Middle District	4.47
Southwest Pennsylvania	4.18
West Virginia	4.00
Buckeye Grade	4.00
Zanesville Grade	3.04
Illinois Basin	3.15
Canada:	
Leduc-Woodbend	2.74
Redwater (Alta)	2.63
Smiley (Sask.)	2.40
Pembina	2.61

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.5°-16.9°, Caripito	2.45
Lagunillas heavy, flat, Amuay or Las Piedras*	2.38
Bachaquero, flat, Las Piedras*	2.23

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 36.0°-36.9°, Fao	2.00
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9°, Umm Said	2.23
Middle East, E. Mediterranean:	
★ Arabian, 36.0°-36.9°, Sidon	2.59
★ Iraq, 36.0°-36.9°, Tripoli, Banias	2.59
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

Carib.-U.S.N.H., dirty (USMC—55%)	$1.22
★ P.G.-Japan, dirty (USMC—60%)	3.60
★ P.G.-U.K., dirty (Scale—50%) (27s. 1d.)	3.78
Gulf-U.S.N.H., clean (USMC—35%)	1.85

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Box K-335,
The Oil and Gas Journal
Tulsa, Oklahoma.

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SITUATIONS WANTED

PETROLEUM ENGINEER, 28, three years experience in production and reservoir engineering with major oil company. Desires foreign position. Presently employed. Box K-348, The Oil and Gas Journal, Tulsa, Oklahoma.

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SALES ENGINEER — Canada — Want increased technical sales western Canada? Engineering firm, registered professional engineer calling oil industry. Desires accounts commission basis, excellent contacts. Osborn Engineering, 10946 117 St., Edmonton, Alberta.

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I OWN proven oil lease, 2000 ft. depth, and drilling rig in Caldwell County, Texas. Will sell ¾ interest in order to develop lease. 1007, 12th St., Orange, Texas.

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4-Corners Area. November Indian Lease sale brought 30 Million Dollars. Some leases sold for $3,200 per acre. Wells estimated up to 1500 barrels of oil per day. Oil Leases from $2.25 an acre. Fortunes being made. Write for free information now. **ATLAS OIL SURVEY, Dept. OJ-8, Colorado Bldg., Denver 2, Colo.**

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EQUIPMENT MEN...

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Formation of Hoke-Manostat Corp., Englewood, N. J., has been announced by Donald B. Salmon, president of the new firm.

The corporation has been organized to market precision industrial instruments developed by Manostat Corp. and manufactured in part by Hoke, Inc. The current line of products includes three models of the cartesian manostat—a precise instrument for the control of flow, pressure and vacuum —and a highly accurate electronic resistance thermometer. A nationwide network of sales representatives will be responsible for distribution of these products.

Besides Salmon, officers of the company include Dr. Roger Gilmont, vice president; Bertram Stone, treasurer; and Earl B. Hitchcock, secretary.

Master Tank Expands Dallas Tank Department

Master Tank & Welding, Dallas, has built an addition to its large tank department. The new building, measuring 50 ft. by 200 ft., houses an overhead crane capable of handling extra-large pressure vessels.

Master Tank's tank department is serviced by a railroad spur running through the end of the building, facilitating shipment and delivery to all parts of the country.

Rebuilding of the tornado-damaged wing of the Master plant in Dallas has been completed, according to Sam Weempe, president.

Sarco Moves Headquarters

Sarco Co., Inc., and Sarcotherm Controls, Inc., manufacturers of steam traps, temperature controls, and heating specialties, will soon move their national headquarters from the Empire State Building, New York City, to expanded office facilities on Madison Avenue. They will occupy the twelfth floor of a newly constructed building. The company's manufacturing facilities are in Bethlehem, Pa.

ADVERTISERS in this issue

A

ACF Industries, Incorporated, Valve Division 43
Acme Oil Tool Company 51
American Blower Division of American-Standard 13
American Chain Division of American Chain & Cable 169
American Iron & Machine Works Co. 18
Automatic Electric Sales Corporation 26

B

Baird Mfg. Co. 180
Baker Oil Tools, Inc. 128
Bank of Montreal, The 178
Beech Aircraft Corporation 115
Bendix Aviation Corporation 132
Bethlehem Steel Co. 126
Bovaird Supply Co., The 1
Brown Oil Tools, Inc. 14
Byron Jackson Pumps, Incorporated, A Subsidiary of Borg-Warner Corporation 36

C

Campbell Chain Company, The 154
Caterpillar Tractor Co. 85
CF&I Tubular Products, The Colorado Fuel and Iron Corporation 31
Chicago Bridge & Iron Company 77
Classified Advertising 193, 194, 195, 196
Coffing Hoist Division, Duff-Norton Company 49
Continental-Emsco Company— 158 through 163
Core Laboratories, Inc. 170
Crose Manufacturing Co., Inc., M. J. 138

D

Dowell Incorporated 120
Drilling & Service, Inc. 184
Duff-Norton Company 49

E

Eastman Oil Well Survey Company 16
Electro-Motive Division General Motors 54, 55
Elgen Corporation, The 46
Engineered Oil Tools, Inc. 47
Engineering Controls, Inc. 127
Enjay Company, Inc. 140

F

Fairbanks, Morse & Co. 4
Fleet-Line Co. 139
Flint Steel Corporation 168
Fluid Packed Pump Company 44, 45
Franks Division of Cabot Shops, Inc. Inside Back Cover
Fuller Company 30

G

General American Transportation Corporation 58
Girdler Company, The 19
Goodrich Company, B. F. 5
Goodyear Tire & Rubber Company, The 17
Grancell, I. H. 143
Grant Oil Tools Co. 123
Guiberson Corporation 34

H

Halliburton Oil Well Cementing Co. Inside Front Cover, 24, 25
Harbison-Fischer Mfg. Co. 56
Hughes Tool Co. Back Cover
Hutton & Co., W. E. 179

I

Ideco, one of the Dresser Industries 20
Inferno Co., The 149

J

Johnston Testers, A Subsidiary of Schlumberger Well Surveying Corporation 41
Jones & Laughlin Supply Division 12
Joy Manufacturing Company 144

K

KLM Royal Dutch Airlines 167

L

Larkin Packer Company, Inc. 10
Link-Belt Company 7
Lone Star Steel Company 117

M

Magnet Cove Barium Corp. 181
Martin, Manufacturer, John N. 27
Master Electric Company, The 15
McCullough Tool Company 50
Minneapolis-Honeywell Regulator Co., Industrial Division 134, 135
Mission Mfg. Company 147
Mixing Equipment Co., Inc. 148
Moore Corporation, Lee C. 52
Mueller Co. 28

N

National Aluminate Corp. 81
National Supply Co., The 37, 38, 39, 40
Industrial Products Division 155

O

Oil and Gas Journal, The 138
Oil Center Tool Co. 32, 33
Oil Well Supply Division 6
Oliver Corporation, The 9

P

Pacific Pumps, Inc. 145
Parkersburg Rig & Reel Co. 29
Payne Manufacturing Company, Inc. 118
Penn Controls, Inc. 165
Petroleum Distributing Co. 149
Petroleum Electric Power Assn. 21
Petroleum Equipment Suppliers Association 23
Plastic Applicators, Inc. 136

R

Reilly Tar & Chemical Corp. 152
Republic Steel Corporation 130, 131
Reynolds Metals Company 62, 63
Robbins & Myers, Inc. 156
Ross Heat Exchanger Division of American-Standard 22
Ross-Martin Co. 139
Ryerson & Son, Inc., Joseph T. 150

S

Sargent Engineering Corporation 124
Schlumberger Well Surveying Corp. 57
Shaffer Tool Works 42
Sheffield Steel Division, Armco Steel Corporation 141
Shell Development Company 11
Southwest Industries, Inc. 8
Stoody Co. 142

T

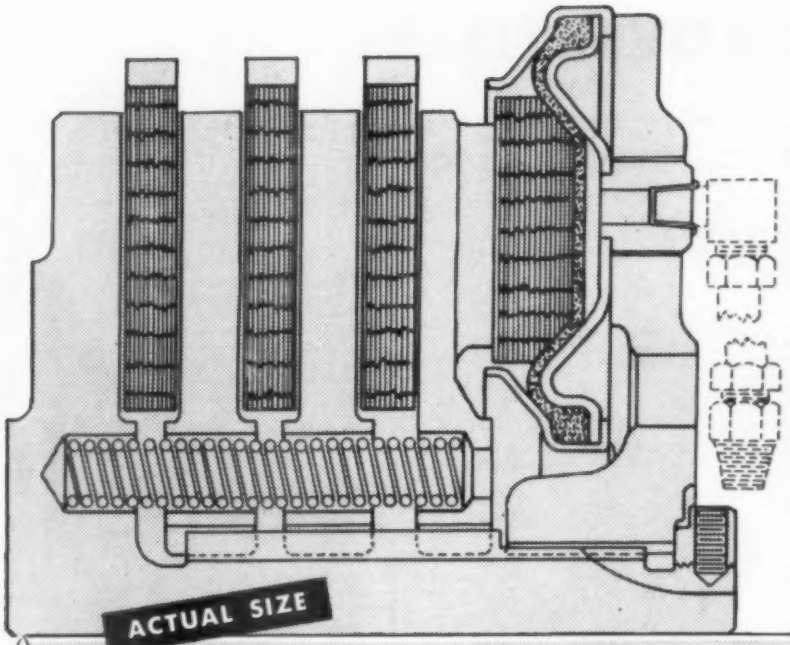
Templeton, Kenly & Co. 143
Texsteam Corporation 138
Thomas Flexible Coupling Co. 166
Timken Roller Bearing Company 35
Twin Disc Clutch Co. 198

U

Union Carbide Corporation— Union Carbide Chemicals Company 157
Unit Rig & Equipment Co. 48
United Air Lines 119
United States Steel Corporation 153
Oil Well Supply Division 6
United Steel Companies, Limited, The 182

W

Warren Petroleum Corporation 60
Welex Jet Services, Inc. 64
Well Equipment Mfg. Corp. 53
Williamson, Inc., T. D. 151
W-K-M Manufacturing Company, Inc., A Subsidiary of ACF Industries, Incorporated 43
Worthington Corporation 169



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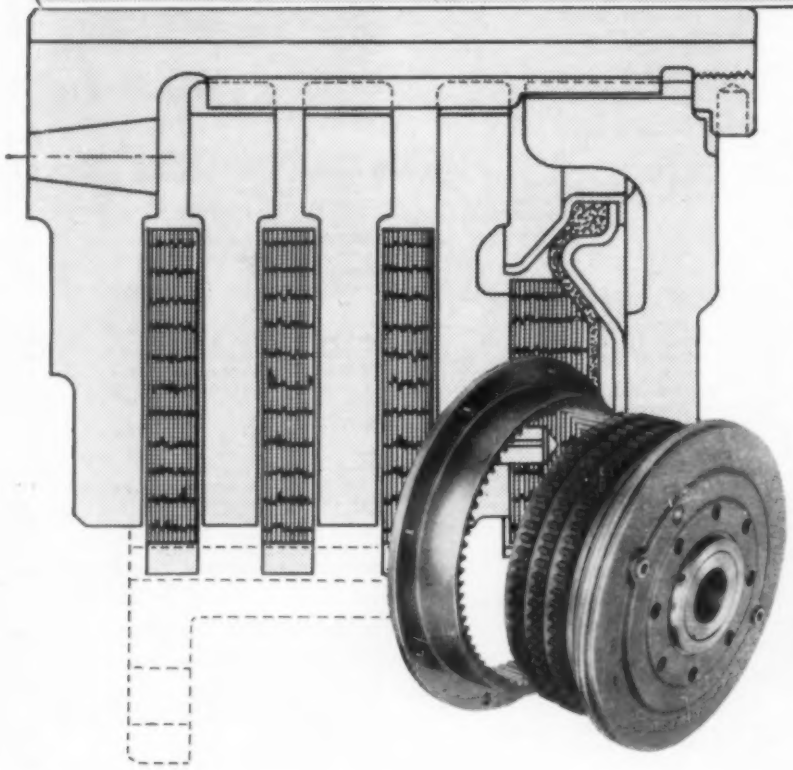

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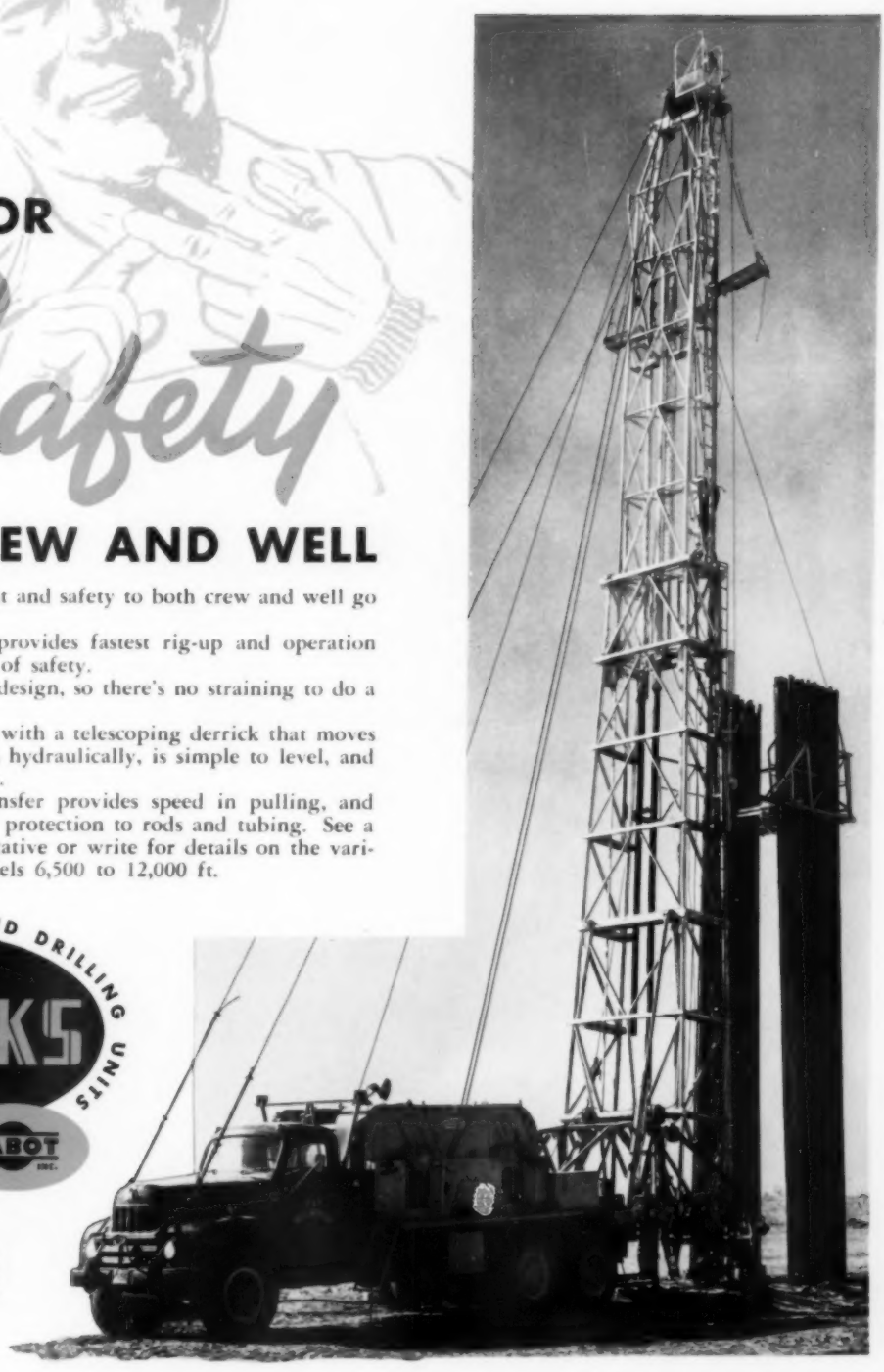

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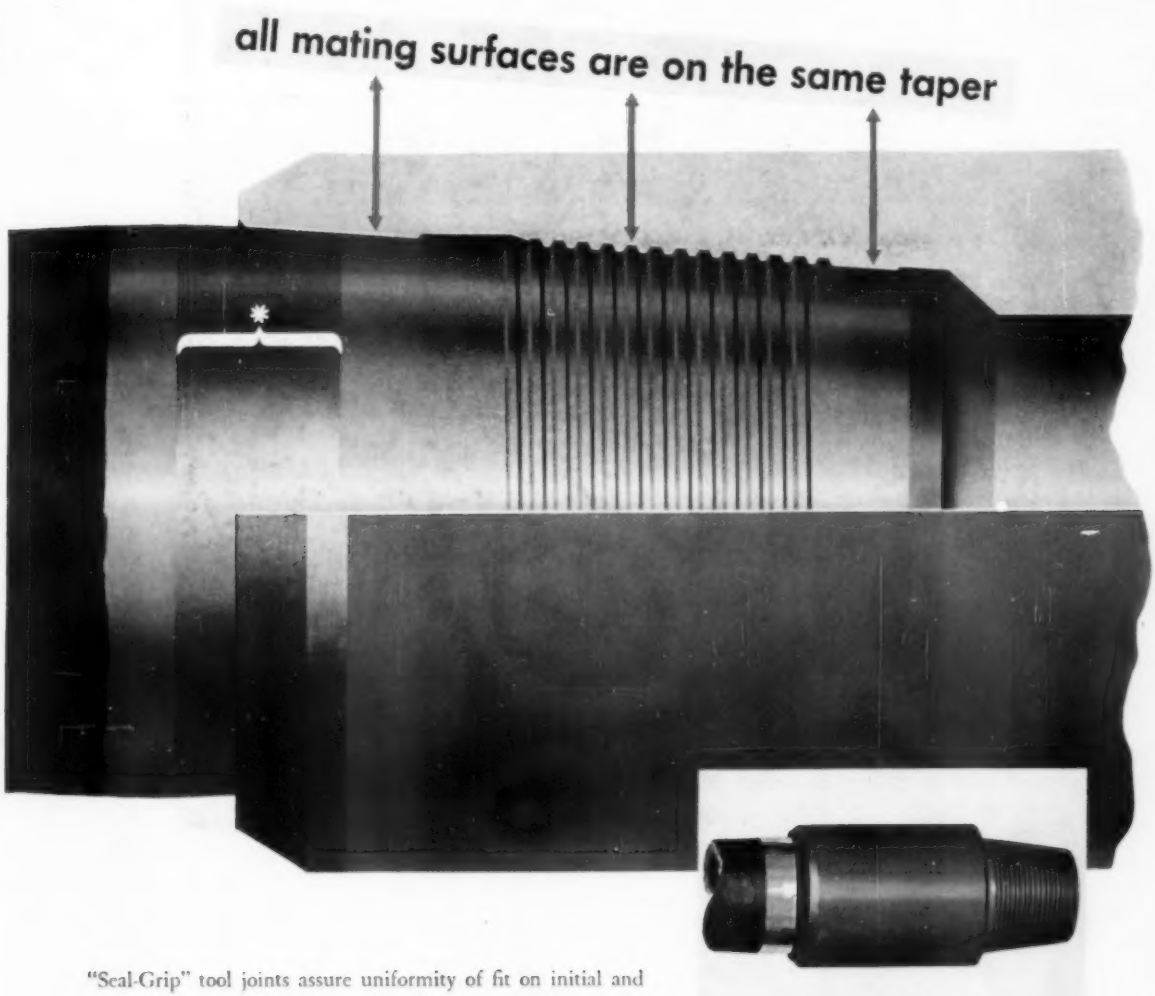

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